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# Information Assurance through Binary Vulnerability Auditing

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# General Schedule and Abstracts

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**The Ohio Academy of Science**
**115th Annual Meeting**
Hosted by
**University of Dayton**
April 21-22-23, 2006

## About the Annual Meeting

The Ohio Academy of Science's Annual Meeting is for academic, governmental, and industry scientists and engineers, university and pre-college educators and teachers, and pre-college, undergraduate, and graduate students, and interested lay citizens in the Ohio region.

## Welcome!

University of Dayton welcomes you to the 115th Annual Meeting of The Ohio Academy of Science. We invite you to explore our campus and to share in the excitement and opportunities provided in this program.

**REGISTRATION:** Registration is required for all meeting presenters and attendees. On-site registration will be available at a higher rate. The Ohio Academy of Science must receive forms by April 10, 2006. Please use Registration Form on the last page. Mail completed form and fee to:

**OAS Annual Meeting Registration**
The Ohio Academy of Science
PO Box 12519
Columbus OH 43212-0519
FAX 614/488-7629 (for Credit Card or PO only)

Registration by credit card or purchase order only will be accepted by FAX at 614/488-7629. Your registration materials, receipt, and name tag will be ready at the meeting registration desk upon your arrival. For further information, please call 614/488-2228.

An Adobe PDF form is available at:

http://www.ohiosci.org/UDRegistrationForm.pdf

Online payment option www.merchantamerica.com/ohiosci

**Friday, April 21**: Registration will not be open on Friday.

**Saturday, April 22**: Registration in Science Hall from 7:30AM-3:00PM. On-site registration is possible by check, VISA, or MasterCard. Cash is discouraged.

**SATURDAY PARKING**: use lots A & B. See map in program.

**SMOKING POLICY:** Smoking is not permitted in any building.

**HOUSING:** Please contact hotels and motels directly. Please review options at the following websites:
http://www.daytoncvb.com/accommodations/

**MEALS:** Friday, April 21. None planned. Saturday, April 22. Lunch available in the Kennedy Union and nearby on Brown Street. See: http://www.udayton.edu/~ku/conference/Dayton_Restaurants.doc

## GENERAL SCHEDULE

### Friday, April 21, 2006

3:00 PM-5:00 PM The Ohio Academy of Science
Board of Trustees Meeting
Kennedy Union Room 222

5:15 PM Presidential Reception
Kennedy Union Barrett Dining Room

6:00 PM Presidential Address
Kennedy Union Barrett Dining Room

***A Legacy of Ohio Geology — accomplishments of naturalists and geologists in the 18th and 19th centuries***

Mark J. Camp, PhD
President, The Ohio Academy of Science
Associate Professor of Geology
The University of Toledo

### Saturday, April 22, 2006

7:30 AM-3:00 PM **General Meeting Registration**
Lobby of Science Center

8:00 AM-9:00 AM **Forensic Science Workshop**
Science Center Room 114

***Current Practices in Forensic Sciences in Real Time***

Arranged by:
Dr. James Y. Tong, President-Elect,
The Ohio Academy of Science
Professor Emeritus, Founder and Director of
Forensic Chemistry (1976-1997) at
Ohio University Department of Chemistry and Biochemistry

**Statement of purpose and background of topic**: There is great interest in Forensic Science among the general public, and particularly among pre-college students, inspired by the over-abundance of crime scene investigation TV shows in recent years and homeland security since the 9/11 terrorist attack on New York City. Science teachers are using forensic science to create interest in science among their students. Some high schools are teaching forensic science.

The purpose of this workshop is to acquaint the students and teachers with the current practices in forensic laboratories, practices that are acceptable in criminal courts and to show the reality of the work of a forensic scientist, in order to dispel the wrong impression that TV-crime scene investigation shows have created. The most important impression we want to convey is that to become a forensic scientist, the students must study science and mathematics in school and be prepared to study and excel in chemistry and biology in college. The workshop also hopes to provide insights and ideas that high school teachers and two-year program instructors can incorporate into their science courses and to provide a forum for them to ask questions and get answers from experienced professional forensic scientists.

**Significance of the topic to science and society**. Forensic Science has kindled new interests in science by students in many levels, and we want to encourage the participation of teachers to utilize and enhance their students' interests. The workshop is intended to correct the misconceptions of scientific methods and instruments and to distinguish the roles of forensic scientists and crime scene investigators, the two professions that have very different requirements and preparation. We plan to provide ideas for teaching and science fair projects.

**Targeted audiences**: (1) Students and teachers in secondary schools, (2) students and instructors in 2-year and 4-year programs in criminalistics and law enforcement technology, (3) college students in forensic science programs.

**Intended learning objectives and benefits for participants**: (1) to learn some of the current practices in forensic sciences in Ohio, (2) to learn the reality of forensic science methods that is wrongly portrayed on TV, (3) to learn the difference between a forensic scientist and a crime scene investigator, (4) to provide teachers with practical ideas to incorporate into their science courses to stimulate student interest and (5) to obtain answers to forensic science questions from experienced forensic scientists.

**Workshop format:** We have chosen three major areas of forensic sciences that are objective and the methods and interpretation have been verified by the application of the scientific methods: Firearm residue Analysis, DNA Analysis, and Forensic Toxicology. Each expert will give a 15-minute presentation. The floor will then be open for 30 minutes of questions and answers. Printed materials on forensic science, sample experiments, and ideas for science fair projects will be distributed.

**Qualification and addresses of the arranger and speakers.**

James Y. Tong, Ph.D., Professor Emeritus, Former Director of Forensic Chemistry, Department of Chemistry and Biochemistry, 136 Clippinger Laboratories, Ohio University, Athens OH 45701, tong@ohiou.edu.

Bill Dean, M.S. Forensic Science, Chief of Forensic Sciences, Hamilton County Coroner's Crime Laboratory, 3159 Eden Ave, Cincinnati OH 45219, Bill.Dean@hamilton-co.org.

Paul Bogg, B.S. Forensic Chemistry, Crime Lab Director 1, Ohio State Highway Patrol Crime Laboratory, 1583 Alum Creek Dr., Columbus OH 43209, pboggs@dps.state.oh.us.

Denise Rankin, B.S. Forensic Science, Biology and Trace Evidence Supervisor, Miami Valley Regional Crime Lab, 361 W. Third St, Dayton OH 45402, rankind@mcohio.org.

9:00 AM - 11:00 AM **Forensic Science Symposium**:
Science Center Room 114

## *Current Research in Forensic Sciences in Ohio*

Arranged by:
Dr. James Y. Tong, President-Elect,
The Ohio Academy of Science
Professor Emeritus, Founder and Director of
Forensic Chemistry (1976-1997) at
Ohio University Department of Chemistry and Biochemistry

**Purpose and background of topic**: There is great interest in Forensic Science among the general public, and particularly among students in secondary schools, inspired by the over-abundance of crime scene investigation TV shows in recent years and homeland security since the 9/11 terrorist attack on New York City. More students are looking for college programs in forensic science and many universities and colleges are rushing to start baccalaureate programs in forensic science to reap the financial benefit of a larger student body in the sciences.

As the term Forensic Science covers many disciplines, the first objective of the proposed symposium is to present samples of current forensic science research in Ohio in some of the major disciplines: Forensic Anthropology, Forensic Biology, Forensic Chemistry, Arson and Explosives, Toxicology and application to pharmacology, and Forensic Science applications to protect food from contamination.

The second objective is to initiate a discussion of the trends in forensic science education from the scientific, economic, and educational standpoints: should forensic science education pursue a generalist or specialist approach. Four of the speakers are from the academic community; three speakers represent three different types of forensic science laboratories.

**Significance of the topic to science and society.** Forensic Science has kindled new interests in science, and the existing forensic science programs have experienced dramatic growth in the ten years before the current rage. Starting new forensic science programs should benefit both the colleges and the students economically. However, an over-supply of graduates could lower the starting salary in forensic laboratories and could leave a large number of graduates with no job. This imbalance of supply and demand can be remedied by training the forensic scientists as good scientists in one major field and train them as a specialist in one of the disciplines in forensic science (the specialist approach). Such students can find jobs in their major field if no jobs in forensic labs are available. As the science and technology advance rapidly, students trained in the specialist approach will have more options than students trained in the generalist approach. The students in the B.S. in forensic chemistry program clearly demonstrate that the specialist approach is superior to the generalist approach. Yet many of the new programs are taking the generalist approach.

**Targeted audiences**: (1) forensic scientists, (2) college educators and administrators, (3) other scientists in different disciplines who are curious about forensic science (4) pre-college students and their parents and (5) the lay public.

**Intended learning objectives and benefits for participants**: (1) to know some of the current research in forensic sciences in Ohio, (2) to start college educators and administrators thinking about the question: Should forensic science education pursue a generalist or a specialist approach?

**Symposium Content, Format, and Schedule**: Dr. James Y. Tong, will moderate the panel and introduce the speakers. Each of the 7 speakers will give 15 minute presentations from the podium, with a short technical questions and answer periods after each presentation. The discussion on the question "should forensic education pursue a generalist or a specialist approach?" will be held for the end of the presentations.

**ION AND DIFFERENTIAL MOBILITY SPECTROMETRY PORTABLE TOOLS FOR CRIME SCENE INVESTIGATIONS**. Peter de B. Harrington, Ohio University Center for Intelligent Chemical Instrumentation, Clippinger Laboratories, Athens OH 45701-2979.

Ion mobility spectrometry (IMS) has afforded field portable instruments for more than a decade. These instruments have been used by law enforcement and security for detecting drugs of abuse and explosives. Handheld models were developed for chemical weapons detection by the military. The popularity of IMS arises from its high sensitivity, low cost, ruggedness, fast response, and small size. Differential mobility spectrometry (DMS) is a micro-machined instrument and furnishes a newer mode of ion mobility measurements that complements IMS. Two new instruments will be reviewed. The first is a Smiths Light Weight Chemical Detector that was designed for detecting chemical weapons for the military. The innovations of this handheld sensor are dual channel detection that simultaneously detects positive and negative ions and a corona discharge ion source. This instrument can detect part-per-billion concentrations of some organics in air. The second instrument is a micro-machined DMS that has been interfaced to a gas chromatographic detector. This instrument has a photo-ionization source and dual channel capability as well. This instrument is used for characterizing jet fuel and detecting arson samples.

**A NEW, FAST-GC METHOD FOR THE ANALYSIS OF HIGH-EXPLOSIVES**. Glen P. Jackson, Ohio University, Dept of Chemistry and Biochemistry, 175 Clippinger Laboratories, Athens OH 45701.

The detection of a mixture of nine explosive compounds, including nitrate esters, nitroaromatics and a nitramine in less than 140 seconds is described. The new method employs a commercially-available pulsed-discharge electron capture detector (PDECD) coupled with a microbore capillary gas chromatography (GC) column in a standard GC oven to achieve on-column detection limits between 5 and 72 fg for the nine explosives studied (N=3). The PDECD has the benefit that it uses pulsed plasma to generate the standing electron current instead of a radioactive source. The fast separation time limits on-column degradation of the thermally-labile compounds and decreases the peak widths, which results in larger peak intensities and a concomitant improvement in detection limits. The combination of short analysis time and low detection limits make this method a potential candidate for screening large numbers of samples that have been prepared using techniques such as liquid-liquid extraction or solid-phase microextraction. Fast-scanning tandem mass spectrometry is currently being explored as an alternative detection method to the PDECD for confirmatory analyses of the same explosives.

**FORENSIC ZOOLOGY: FROM CLAIMS OF BIGFOOT HAIR AND TRACKS TO FINDING ELUSIVE ENDANGERED FROGS.** Scott M. Moody, moody@ohio.edu, Dept of Biological Sciences, Ohio University Athens OH 45701.

Often, comparative vertebrate zoologists are enlisted by criminal investigators to identify whether discovered bones and teeth are of human origin. The annals of forensic investigation have many classic case histories. Public interest in the question of the valid existence of a scientifically unrecognized species of large bipedal ape in North America vernacularly known as Bigfoot is high because of TV documentaries. However, scientific analysis of uncontaminated physical evidence by independent observers rarely happens. Investigation of purported "Bigfoot tracks" in Athens County, Ohio in 2002 revealed that they were "erosional artifacts" caused by rain water eddies disproportionately removing soil between rock pebbles. This process was duplicated under experimental conditions. The international trafficking of illegal animal skins is a multi-billion dollar industry, and the U.S. Customs and U.S. Fish and Wildlife Service employ many forensic zoologists to protect endangered species populations. A dead frog found in a frozen pizza was identified narrowing the source of contamination to suppliers in Ohio, rather than Mexico as the company had claimed. Zoologists who study endangered animal species are often thwarted because of the scarcity of individuals. Fifteen new populations of the Eastern Spadefoot, Scaphiopus holbrook (Amphibia; Anura), and Ohio's only species of frog officially listed as endangered have been discovered during the past 20 years. Forensic parameters of the four previously known sites were developed based on geological and soil characteristics of glacial sand and gravel terraces.

**APPLICATIONS OF FORENSIC ANTHROPOLOGY.** Nancy E. Tatarek, tatarek@ohiou.edu, Dept of Sociology and Anthropology, 149 Bentley Annex, Ohio University, Athens OH 45701-2979.

Forensic anthropology, a sub-discipline of applied physical anthropology, identifies human remains in situations which generally result in civil and criminal litigation. Problems of personal identification arise from instances of suicide, homicide, missing persons and mass disasters. Recovering and analyzing remains unrecognizable by conventional methods, forensic anthropologists endeavor to identify the deceased and render opinions relevant to time and manner of death. Increasing utilization of forensic anthropologists by federal, state and local agencies indicates the value of the field. Focusing on a team approach, the field blends the skills of archaeological field techniques, determining a 'biological profile', skeletal pathology and trauma, and factors of personal identification. Forensic anthropology can be utilized to determine non-human remains from human remains; to recover human remains from outdoor settings and to analyze remains altered by

fire. Additionally, forensic anthropologists are often asked to identify remains when traditional methods (e.g. fingerprinting) do not yield results.

**SURVIVABILITY RATE OF LATENT FINGERPRINTS ON IMPROVISED EXPLOSIVE DEVICE (IED) COMPONENTS**. Sonja L. Rawn, slrawn@com.state.oh.us, Forensic Lab, Division of State Fire Marshal, 8895 East Main St., Reynoldsburg OH 43068.

Components of explosive devices that are often encountered in a forensic laboratory latent print section are made of everyday materials. The difference, of course, is that they are fragmented, burned and or melted due to the explosion process. It is widely believed that this harsh environment deteriorates any prints deposited on bomb components. This study, utilizing controlled detonation and common explosive device components, was designed to determine if it is possible to recover latent fingerprints (utilizing established procedures), what type of components are the most likely to retain the prints and a successful development time window. Results (summarized below) indicate that it is possible to develop latent fingerprints on explosive device components after an explosive incident. It was found that the development time interval (scene – two weeks) made little difference. Latent survivability followed predictable patterns: the less low explosive filler utilized the more prints were developed; devices with more pressure build-up (metal pipe) yielded fewer prints; more prints were developed on porous items and tapes than on non-porous items and high explosive devices yielded few developed prints.

**OTC COLD MEDICATIONS: POSTMORTEM FINDINGS IN INFANTS AND RELATIONSHIP TO CAUSE OF DEATH.** Laureen Marinetti M.S., Ph.D., MarinettiL@mcohio.org, Lee Lehman, Ph.D., M.D., Brian Casto, M.D., Kent Harshbarger, M.D., J.D., Piotr Kubiczek, M.D., James Davis, M.D., Montgomery County Coroner's Office, 361 West Third Street, Dayton OH 45402.

The Montgomery County Coroner's Office (MCCO) has encountered a series of 15 deaths in infants less than 12 months old with toxicology findings which include a variety of drugs commonly found in over the counter (OTC) cold medications. The drugs detected were ephedrine, pseudoephedrine, dextromethorphan, diphenhydramine, chlorpheniramine, brompheniramine, ethanol, carbinoxamine, levorphanol, doxylamine and acetaminophen. Toxicology findings were confirmed in two different matrices and by two different analytical methods. Selected cases will be presented including blood and tissue concentrations of the drugs and the case histories as well as the cause of death (COD). The majority of these deaths were either toxicity from the OTC cold medications directly or as a contributory factor in the cause of death. Care givers may be under the mistaken notion that OTC cold medications formulated for children and adults are also safe for use in infants. These cases demonstrate that not only is administration of some OTC cold medications un-safe, inappropriate use of OTC cold medications in infants can result in toxicity that can lead to death.

**MULTI-TECHNIQUE APPROACH FOR FORENSIC DETECTION OF BLEACH ADULTERATION IN PHARMACEUTICAL FORMULATIONS CONTAINING PHENOLS AS PRESERVATIVES.** Jonathan J. Litzau, jlitzau@ora.fda.gov, David S. Jackson, djackson@ora.fda.gov, James A. Turner, jturner2@ora.fda.gov, John R. Urban, jurban@ora.fda.gov, United States Food & Drug Administration, Forensic Chemistry Center, 6751 Steger Drive, Cincinnati OH 45237. As alertness to the possibility of pharmaceutical tampering and adulteration increases, the need for methods to detect such adulteration has also increased. Common household bleach and bleach-containing products, while not considered highly toxic, present a readily available potential source of contamination and can lead to formation of additional substances of higher toxicity when added to finished formulations. Attributing adulteration of pharmaceutical products to bleach contamination can be challenging as secondary reactions and subsequent degradation of intact sodium hypochlorite often occur. For this study, results from multiple analytical techniques (GC-MS, LC-MS, LC-UV, and IC) as well as data from elemental analysis and wet chemical tests were employed to detect and characterize bleach contamination of pharmaceuticals containing phenolic compounds such as m-cresol, a common preservative. GC-MS and electrospray ionization LC-MS were used to monitor the formation of several chlorinated phenols resulting from the reaction of sodium hypochlorite and the preservative. Mono-, di-, and tri-substituted chlorinated aromatics were observed, the ratios of which could be related to the amount of bleach contamination. Timed experiments (t = immediately after spike, 4 days, and 7 days) were performed that indicated immediate formation of the chlorinated phenols and stable concentration ratios of reaction products. LC-MS was used to examine the fate of the active pharmaceutical ingredients after bleach adulteration. By linking data from multiple techniques, it was possible to detect and characterize bleach contamination levels ranging from 5 to 25%.

9:00 AM - 11:00 AM **Morning Podium Sessions in Science Hall**

**Morning Poster Sessions in Kennedy Union**

11:15 AM - 12:00 Noon **All Academy Lecture Kennedy Union Boll Theatre**

### *Molecular Imaging and Targeted Therapeutics For Personalized Medicine*

Samuel A. Wickline, M.D.
Professor of Medicine, Physics, Biomedical Engineering, and Cell Biology and Physiology
Washington University, St. Louis.

The next generation of pharmaceutical agents will be targeted against specific molecular pathways and/or locales within the body. Our laboratory is engaged in a multidisciplinary effort to develop systemically deliverable ligand-targeted nanoparticles for noninvasive in vivo image-based detection of picomolar quantities of pathological epitopes that are the sources of cancer and cardiovascular disease. We have devised strategies for

delivering drugs or genes to those sites with the use of targeted nanoparticle carriers that can incorporate various classes of ligands (e.g., antibodies, small molecules) and selected drugs active against cancer and atherosclerosis and thrombosis. These particles also can be imaged in vivo with MRI, nuclear, CT, or ultrasound methods based on incorporation of payloads of gadolinium chelates, radionuclides, iodinated compounds, or perfluorocarbon content respectively. Targeted contrast agents can detect unstable atherosclerotic lesions through identification of fibrin deposited within plaque microfissures, adhesion or thrombogenic molecules expressed on endothelium of vulnerable plaques, tissue factor expression in inflammatory lesions, or angiogenic activity (i.e., expanding vasa vasorum displaying $\alpha_v\beta_3$-integrins). Similar targets are available for detecting tumor angiogenesis.

These targeted agents also permit the loading of large payloads of potent drugs such as doxorubicin, taxol, fumagillan that can be incorporated and delivered selectively to individual cells through a novel process of "contact facilitated drug delivery." The response (e.g., plaque or tumor regression) to such localized therapies can be predicted and followed serially with image-based readouts indicative of drug efficacy in individual subjects. Accordingly, both molecular imaging and targeted therapy should facilitate the emergence of personalized medicine in concert with the development of new nanotechnologies that are expected to assume a critical role in management of individual patients in the post-genomics era.

**About Professor Wickline**

Samuel A. Wickline is Professor of Medicine, Physics, Biomedical Engineering, and Cell Biology and Physiology at Washington University. He received the B.A. degree from Pomona College, Claremont, CA in 1974 and the M.D. degree from the University of Hawaii School of Medicine, Honolulu, HI, in 1980. He completed post-doctoral training in Internal Medicine and Cardiology at Barnes Hospital, St. Louis, MO in 1987 and joined the faculty of the School of Medicine in the Cardiovascular Division before becoming Director of the Cardiovascular Division at Jewish Hospital and subsequently Co-Director of the Cardiovascular Division at Barnes-Jewish Hospital. He is Co-Director of the Cardiovascular Bioengineering graduate Program at Washington University and a member of the executive faculty of the Institute for Biological and Medical Engineering.

Dr. Wickline initiated the Cardiovascular Ultrasound Laboratory in 1987 and the Cardiovascular Magnetic Resonance Laboratories in 1995 at Washington University School of Medicine. These laboratories are devoted to both basic and translational clinical research focused on image-based detection and quantification of physiologic and pathologic structure and function of heart and vascular tissues. He also initiated a program in molecular imaging in 1994 following the development of a novel nanoparticulate contrast agent useful for multiple imaging modalities that can be targeted to molecular ligands for diagnostic and therapeutic applications. Recently he initiated the "Center for Applied Nanomedicine" at Washington University devoted to diagnostic and therapeutic development of nanotechnology in concert with corporate and academic partners for broadbased clinical applications.

Dr. Wickline has served as an Established Investigator of the American Heart Association. He is a member of the American Society for Clinical Investigation. He also serves on the Board of Directors of the Society for Cardiovascular MR, and has served as Chairman for its Annual Scientific Program in 1999 and 2000. He is a founder of Kereos, Inc., a local biotech startup company devoted to molecular imaging and targeted therapeutics.

He is the author of over 140 research papers in these and related fields. He currently is Principal Investigator on 2 RO1 grants, a Biomedical Partnership Grant (BRP) from the National Institutes of Health, and is the PI on the "Siteman Center For Cancer Nanotechnology Excellence" U54 grant at Washington University. He also holds more than 30 issued or filed U.S. patent applications.

12:00 Noon **Lunch**
Available in Kennedy Union and at restaurants on Brown Street. See Registration Desk for list.

12:00 Noon **Official Notice of Annual Business Meeting**
for Academy Members Only.
Science Center Room 119

1:30 PM-3:30 PM **All-Academy Symposium:**
Kennedy Union Boll Theatre

***Science and Engineering on a Nanoscale: The impact and promise of nanotechnology on research, teaching, and society***

**Arranged and Sponsored by:**
University of Dayton OAS Planning Subcommittee
Co-Chair Jayne Robinson
(Jayne.Robinson@notes.udayton.edu)
Co-Chair Carissa Krane
(Carissa.Krane@notes.udayton.edu)

University of Dayton
Department of Biology
300 College Park
Dayton, OH 45469-2320
(937) 229-2580

**Statement of Purpose and Background of Topic:** This forum is designed to expand upon the overall theme of the meeting, "Science and Engineering on a Nanoscale", and is intended to provide discipline-specific presentations on the use of nanotechnology in research and education. The proposed symposium will provide broad interests topical presentations on the current and future use of nanotechnology as applied to scientific subdisciplines (biology, chemistry, geology, biomedicine, ecology, environmental biology), engineering (materials, sensors, electro-optics), and the impact of nanoscale developments on science and engineering education. The symposium chair will introduce the symposium with a brief 15 minute overview, to be followed by five oral presentations, 15 minutes each, from presenters in each of the following disciplines: materials science engineering, electro-optics, R&D, biology, and science & engineering education. Each talk will be followed by 5 minutes of Q&A with significant audience

participation. The goal of this format is to inform and promote discussion among scientists and engineers of different disciplines in order to facilitate important inter-disciplinary collaborations.

**Significance of topic to science and society**: Nanotechnology has permeated our society in many important and instrumental ways, extending from the design and implementation of explosive detection instrumentation at airports to the use of nanoscale biomarkers and inducible beacons in detecting human diseases such as cancer. National research funding agencies including the NIH and NSF have identified nanotechnology as a major focus of future funding, and are heavily promoting multi-disciplinary team approaches towards solving problems in all areas of science, engineering, and technology. The Departments of Defense, Homeland Security, and Energy are keenly interested in the applications of nanoscale technologies that are currently in use, and the promise of nanoscale developments, prompting public policy decisions regarding the allocation of funds and the legal, and ethical uses of this technology in the United States and abroad. Therefore, this symposium provides a timely and important forum for discussing the immediate and broader impacts of nanotechnology on OAS members, their research, and society in general.

**Target audience:** The target audience is the broad membership of the OAS and meeting attendees. The speakers have been asked to prepare talks of broad appeal to a diverse audience comprised of teachers, students, scientists and engineers at all levels.

**Intended learning objectives and/or benefits for participants**: The learning objectives are two fold: 1.)Educate the audience on the state of research and diverse applications of nanoscale science and engineering currently in place; 2.)Provide a forum for colleagues in different disciplines to learn about what is happening in other fields to foster interdisciplinary collaborations.

**Symposium Content and Format**: The symposium chair will introduce the symposium with a brief 15 minute overview, to be followed by five oral presentations, 15 minutes each, from presenters. Each talk will be followed by 5 minutes of Q&A with significant audience participation. The Chair of the symposium will offer closing remarks to conclude the session.

**1:30 p.m. INTRODUCTION: SCIENCE AND ENGINEERING ON A NANOSCALE: NANOTECHNOLOGY AND THE FOURTH INDUSTRIAL REVOLUTION.** Presented by Symposium Chair, Liming Dai, Ph.D., Liming.Dai@notes.udayton.edu, Dept of Chemical and Materials Engineering, School of Engineering and UDRI, University of Dayton, Dayton OH 45469.

**1:45 p.m. BIOLOGICAL NANOMACHINES**. Panagiotis Tsonis, Ph.D., Panagiotis.Tsonis@notes.udayton.edu, Professor of Biology and Leonard A. Mann, S.M, Chair of Science, University of Dayton, Dept of Biology, Dayton OH 45469.

2:00 p.m.Questions from the audience

**2:05 p.m. NANO AND BIO CARBON FOAM IN FUNCTIONAL BIOLOGY AND THERMAL MANAGEMENT.** Khalid Lafdi, Ph.D., lafdi@udri.udayton.edu, Mechanical and Aerospace Engineering, University of Dayton, Dayton OH 45469.

2:20 p.m.Questions from the audience

**2:25 p.m. NANOPHOTONICS**. Joseph W. Haus, Ph.D., Joseph.Haus@notes.udayton.edu, Director, UD Graduate Program in Electro-Optics, University of Dayton, Dayton, OH 45469.

2:40 p.m. Questions from the audience

**2:45 p.m**. **THE IMPACT AND PROMISE OF NANOMATERIALS TO AEROSPACE APPLICATIONS**. Tia Benson Tolle, Ph.D., Tia.BensonTolle@wpafb.af.mil, Chief, Structural Materials Branch, Materials and Manufacturing Directorate, Air Force Research Laboratory, USAF, Dayton OH 45433 .

3:00 p.m. Questions from audience

**3:05 p.m. EDUCATING THE ENGINEER OF 2020: ADAPTING ENGINEERING EDUCATION TO THE NEW CENTURY.** Richard Taber, Program Officer, National Academy of Engineering, Washington DC 20418.

3:20 p.m. Questions from audience

**3:25 p.m. Closing remarks**, Dr. Liming Dai.

**Symposium Summary:** This symposium is designed to expand upon the overall theme of the meeting, "Science and Engineering on a Nanoscale", and will provide broad interest topical presentations on the current and future use of nanotechnology from investigators involved in the research, development, and implementation of this technology. The objective of this symposium is to provide a timely and important forum for discussing the immediate and broader impacts of nanotechnology on OAS members, their research, and society in general. The 15 minute talks will be aimed at a general science and engineering audience. All OAS members and meeting attendees are invited to attend and ask questions during the 5 minute Q&A period following each talk.

**SCIENCE AND ENGINEERING ON A NANOSCALE: NANOTECHNOLOGY AND THE FOURTH INDUSTRIAL REVOLUTION**. Liming Dai, Liming.Dai@notes.udayton.edu, Dept of Chemical and Materials Engineering, School of Engineering and UDRI, University of Dayton, Dayton OH 45469-0240.

Humans have benefited nanotechnology and nanomaterials for centuries though we were not aware due to our limited ability to see and control matter at a billionth of a meter. Every living cell is filled with natural nanomachines of DNA, RNA, proteins, etc., which interact to produce tissues and organs. All creatures great

and small are made up of some nitrogen, oxygen, hydrogen, carbon, calcium, a little sulfur, iron, phosphorus, and some other elements. At the cellular level, nature handles these inexpensive building blocks, which man has known for centuries, by assembling various nanostructures that enable organisms to function. However, traditional manufacturing methods including casting, grinding, and milling are crude from the perspective of the molecular level. Recent developments in nanoscience and nanotechnology have resulted in many tools and methods, to build nanometer-scale materials and devices atom-by-atom or molecule-by-molecule. By creating nanostructures, it is possible to control the fundamental properties of materials even without changing the materials' chemical composition. This, together with so many nanotools already reported and more to be developed, should enable us to develop numerous new materials and devices of desirable properties and functions for various applications in medicine, health, environmental detection, and national defense, among others. The age of nanotechnology is upon us. Engineering at the molecular level is no longer a computer-generated curiosity. It is beginning to affect the lives of everyone.

**Biographical Sketch**: Dr. Liming Dai joined the University of Dayton in September, 2004, as the Wright Brothers Institute Endowed Chair in Nanomaterials. As a full professor in the School of Engineering with a joint appointment at the University of Dayton Research Institute, he is responsible for establishing UD's new nanomaterials lab and guiding research at the University in collaboration with the Manufacturing Directorate of the Air Force Research Laboratory. Dr. Dai received his B.S. degree in polymer science and engineering from Zhejiang University in 1983 and a Ph.D. in chemistry from the Australian National University in 1990. He accepted a postdoctoral fellowship in physics from the Cavendish Laboratory at the University of Cambridge, and two years later became a visiting research faculty member in the department of materials science and engineering at the University of Illinois. Dai spent 10 years with the Commonwealth Scientific and Industrial Research Organization (CSIRO) in Australia. Before joining the University of Dayton, he was a polymer engineering faculty at the University of Akron. Dr. Dai serves as an Editorial Board Member for the Journal of Nanoscience and Nanotechnology and a Regional Receiving Editor for the Australian Journal of Chemistry – an International Journal of Chemical Science. He has published over 150 scientific papers, a research monograph, one edited book, and has received and applied for more than10 patents in the areas of optoelectronic polymers, carbon nanotubes, nanofiber/nanoparticle filled polymers, nanocomposites, polymeric biomaterials, polymers at the surface and interface, polymer photonic and biomedical devices (e.g. sensors, actuators, light-emitting diodes).

**BIOLOGICAL NANOMACHINES**. Panagiotis A. Tsonis, Tsonis@notes.udayton.edu, Dept of Biology, University of Dayton, 300 College Park, Dayton OH 45469-2320.

One aim of nanotechnology is to create devices at the nano-scale and eventually use them for several applications, including biomedicine and tissue engineering. Proteins and DNA are nanomachines that are able to perform important biological tasks. One goal of nanotechnology is to mimic such machines, control them at will, and eventually use them to help understand several conditions, such as diseases. I will attempt to discuss these issues from the biologist's point of view and provide my ideas of collaborations between engineers and the biologist.

**Biographical Sketch**: Dr. Panagiotis Tsonis earned his Ph.D. in Molecular Biology in 1983 from Nagoya University in Japan. He has held academic appointments at several Universities including Scripps, La Jolla Cancer Research Center, San Diego State university, Indiana University, and Joined the faculty at the University of Dayton in the department of Biology in 1989. He is currently a Professor of Biology, and the Leonard A. Mann, S.M. Endowed Chair of the Sciences at the University of Dayton. Dr. Tsonis is internationally known for his research contributions in the areas of lens, limb, and retinal regeneration.

**NANO AND BIO CARBON FOAM IN FUNCTIONAL BIOLOGY AND THERMAL MANAGEMENT.** Khalid Lafdi, lafdi@udri.udayton.edu, Mechanical and Aerospace Engineering, University of Dayton, 300 College Park, Dayton OH 45324-0168.

Recent technological advances in functional biology and thermal management using carbon based materials show promising results. These two areas could use nano-bio carbon foam as materials substitutes. Lack of donor organs has caused many to consider tissue engineering methods as means to replace diseased or damaged organs. This emerging field uses tissue-specific cells in a three dimensional organization, provided by a scaffolding material such as nano-bio carbon foam, to return functionality of the organ. For these applications, the choice of scaffolding material is crucial to the success of the technique. In addition to the chemical properties of the material, physical properties such as surface area for cell attachment are essential. Various methods of creating pores in these materials to increase surface area were investigated here. However, in thermal management one of the most important challenges is the development of high performance materials structures which maintain their structural integrity at various temperatures and are able to manage heat. This problem is particularly important in the cooling of new power electronics and space vehicles. Incorporating a light carbon structure with high mechanical and thermal properties coupled with tailored carbon nanotubes interface will resolve thermal the resistance issue and increase heat transfer efficiency. The same design would allow smart monitoring of cell growth during bone regeneration.

**Biographical Sketch**: Dr. Khalid Lafdi is a Carbon group leader and Professor, in Materials Engineering and Mechanical engineering at the University of Dayton, Dayton, OH. He earned his B.S. and M.S. in Chemical Engineering from University of Nancy (France), a Ph.D. in Physics and Chemical Engineering, from Bordeaux Academy ( France) and a D.Sc. in Materials Physics from Bordeaux Academy (France), and has held academic and research positions in England, Japan, France, and in the U.S. He holds several patents for his work on nanomaterials. Dr. Lafdi's research interests include; biomaterials implants and TiNi/carbon micro-composites as shape memory alloys; design fabrication of physical property devices for micro- and nanometric scale measurements; in situ growth and characterization of nano-constituents (single and multi-walled nanotubes); interface and interphase monitoring in composites;

multifunctional carbon foams: processing, structural and physical properties; nanocomposites processing and physical property measurement; nanotribology and tribochemistry mechanisms of carbons; thermal protection systems: processing and heat transfer modeling.

**NANOPHOTONICS**. Joseph W. Haus, Joseph.Haus@notes.udayton.edu, Director, Electro-Optics Program, University of Dayton, Dayton OH 45469-0245.

A new exciting challenge for the nanophotonics community is the creation of a novel material with optical properties that are entirely contrary to our usual intuition: namely, at the interface the light entering this material is refracted in the opposite direction such that Snell's law is invoked with a negative index. Such new materials are called negative index materials (or NIMs). Indeed among their most interesting properties NIMs can enable lithography or optical imaging that reconstructs details better than the normal resolution limit. To achieve this super-resolution effect in the optical regime requires fabricating a material on a nanoscale with properties that are heretofore unknown in any natural material. The scope of photonics at the nanometer scale with materials, fabrication, and characterization issues will be examined with special interest in new nanophotonics devices that are enabled by this new technology, which covers a wide range of applications from medical to aerospace. Novel materials are being produced using complex designs based on naturally occurring nanometer scaled structures as models. In the laboratory a whole new realm of nanometer scale materials are fabricated to control and engineer the photonic and electronic properties of the complex structures. When incorporated into photonic devices, such as lasers, they provide superior performance for everyday applications.

**Biographical Sketch**: Dr. Joe Haus received a Ph.D. in Physics at Catholic University of America in 1975. He had several post doctoral appointments: the National Bureau of Standards (now National Institute of Science and Technology), the Kernforschungsanlage in Juelich,Germany, the University of Essen in Germany, and the U.S. Army Aviation and Missile Command. He rose through the ranks to professor of physics at Rensselaer Polytechnic Institute (1984-1999) and joined the University of Dayton in 1999 as Director of the Electro-Optics Program. In 1991-1992 he was the Hitachi Limited Quantum Materials Chair at the University of Tokyo. He is a fellow of the Optical Society of America and the SPIE. His areas of research cover nonlinear and quantum optics, especially heterogeneous systems, such as nanoparticles and photonic crystals.

**THE IMPACT AND PROMISE OF NANOMATERIALS TO AEROSPACE APPLICATIONS.** Tia Benson Tolle, Ph.D., Tia.BensonTolle@wpafb.af.mil, Chief, Structural Materials Branch, Materials and Manufacturing Directorate, Air Force Research Laboratory, 2941 Hobson Way, Wright-Patterson Air Force Base OH 45433-7750.

The ability to understand and control matter at the nanoscale has revealed exciting new phenomena, materials, and device capabilities. The impacts on the research community are significant and evident. For example, since 1989 the rate of growth of publications and patents in nanotechnology has accelerated worldwide with average growth rates of up to 80% per year. Investments by governments worldwide increased six-fold between 1997 and 2003, reaching over $3 billion per year in over 30 countries. Nanotechnology is truly pervasive, offering new tools to multiple and diverse disciplines. Products are already emerging in markets ranging from automotive to aerospace, medicine to sporting equipment. Nanotechnology surely will change the face of many technologies across multiple and diverse applications. Some day, drug delivery will be accurate enough to target specific proteins within cells. Solar panels will be powerful enough to replace fossil fuels as our primary energy source. Chemical sensors will be small enough and cheap enough to be scattered in public spaces, detecting toxins before any damage is done. And we will find applications for new classes of nanotailored materials for food packaging and aerospace vehicles. For instance, composites made from carbon nanotubes and epoxy have many potential applications due to their exceptional mechanical, electrical, and thermal properties, characteristic of the individual components with potential synergetic effects. Much research and development into applications of carbon nanotube and other nanotailored composites for military aerospace vehicles focuses on their use as coatings, as reinforcements in structural materials, or as constituents integrated into smart materials. However, many improvements need to be made in the characterization of nanomaterials, understanding the differences between nano and bulk counterparts, and tailoring of the interfaces between the matrix and nanomaterial.

**Biographical Sketch.** Dr. Tia Benson Tolle is currently the Chief of the Structural Materials Branch in the Materials and Manufacturing Directorate, Air Force Research Laboratory, USAF in Dayton, OH. She is responsible for the planning, management, and technical leadership of research programs in advanced organic matrix composites technologies, spanning basic research through applied technologies, worth up to $15 M per year. Research programs include in-house research and contracted research with aerospace industry in the areas of polymeric matrix composite materials development; processing science; carbon fibers; carbon composites; analytical/computational methods; experimental mechanics; failure criteria and predictive modeling. She leads a team of 30 scientists and engineers. She is the Department of Defense Reliance Lead for Structural Materials Panel (USAF, Navy, Army, DARPA), and is the International President of the Society for the Advancement of Material and Process Engineering (SAMPE) international professional technical society, and serves as a mentor in support of women in engineering. She earned her B.S. in Mechanical Engineering from the University of Washington, Seattle, WA, and M.S. and Ph.D. degrees in Materials Engineering from the University of Dayton.

**EDUCATING THE ENGINEER OF 2020: ADAPTING ENGINEERING EDUCATION TO THE NEW CENTURY**. Richard M. Taber, rtaber@nae.edu, Program Officer, National Academy of Engineering, 500 Fifth Street, NW, Keck 1039, Washington DC 20001.

Educating the Engineer of 2020 is grounded by the observations, questions, and conclusions presented in the best-selling book The Engineer of 2020: Visions of Engineering in the New Century. This new book offers recommendations on how to enrich and broaden engineering education so graduates are better prepared to

work in a constantly changing global economy. It notes the importance of improving recruitment and retention of students and making the learning experience more meaningful to them. It also discusses the value of considering changes in engineering education in the broader context of enhancing the status of the engineering profession and improving the public understanding of engineering. Although certain basics of engineering will not change in the future, the explosion of knowledge, the global economy, and the way engineers will work will reflect an ongoing evolution. If the United States is to maintain its economic leadership and be able to sustain its share of high-technology jobs, it must prepare for this wave of change.

**Biographical Sketch:** Richard Taber joined the National Academy of Engineering in October 2004 as a Program Officer with responsibility for the Standing Committee on Engineering Education. The CEE is engaged in numerous activities that relate to including the publication of the Phase I and Phase II reports called "The Engineer of 2020." Prior to joining NAE, Mr. Taber served for three years with Oak Ridge Associated Universities as a corporate and foundation relations consultant with the National Science Foundation. In that position he was responsible for the operational management of an alliance of public and private funders of pre-college and undergraduate education with the goal identifying and disseminating effective funding strategies. Mr. Taber's prior positions include serving as a senior research engineer with the Institute of Textile Technology where he authored many research papers and consulted frequently in the textile industry. Mr. Taber began his industry career as a process engineer and production manager with Milliken & Company. Mr. Taber received his bachelor's and master's degrees in textile technology, respectively, from the Philadelphia College of Textiles and Science (now Philadelphia University) and the Institute of Textile Technology.

3:30 PM - 5:00 PM **Afternoon Poster Session in Kennedy Union**

## Sunday April 23, 2006

9:00 AM - 1:00 PM **Earth Science Field Trip**

### *Investigating geology, geomorphology, and environmental geology in the environs of Dayton*

Organized by Michael Sandy, University of Dayton

This fieldtrip will provide an opportunity to examine aspects of the varied geology in the vicinity of Dayton. Localities to be visited will allow an examination of Ordovician and Silurian bedrock; invertebrate paleontology with opportunities for fossil collecting; consideration of landscape evolution in the vicinity of the Wright Brothers' Flying Field, Huffman Prairie and Glen Helen; the 1913 Flood in the Miami Valley (approximately 400 people drowned), the Miami Conservancy District and construction of Huffman Dam on the Mad River; and aspects of local groundwater contamination affecting one of Dayton's aquifers and remediation.

Localities to be visited will be in the vicinity of the Wright Brothers' Memorial, Greene County and Oakes Quarry Park, Fairborn; Glen Helen, Yellow springs is an optional stop after lunch.

Lunch can be purchased nearby. After lunch an optional additional short-hike through nearby scenic Glen Helen, Yellow springs can be taken. This will allow observation and discussion of: Silurian dolomites; Silurian invertebrate fossils; Pleistocene melt-water drainage and landforms; post-Pleistocene travertine deposition and terrestrial fossils (no collecting).

Meet at 9:00 a.m. at the small traffic-circle near the parking area behind the Science Center (Stewart Street side of the building).

### About Our Host

Chairpersons, Local Arrangements:
Drs. Carissa Krane and Jayne Robinson

University of Dayton (UD) is one of the nation's ten largest Catholic universities and Ohio's largest private university, with an enrollment of more than 10,000 students, including more than 6,800 full-time undergraduates. UD was founded in 1850 by the Society of Mary (Marianists), a Roman Catholic teaching order of priests and brothers. Now UD is a residential learning community with more than 70 academic programs in arts and sciences, business administration, education and allied professions, engineering and law. UD is a diverse community committed to educating the whole person and to linking learning and scholarship with leadership and service. It offers a vibrant living-learning environment, where modern campus housing blurs the line between living and learning.

**Excellent Academics**

UD is ranked seventh among national Catholic universities, and among the top 100 national universities in the country, according to the 2004 issue of America's Best Colleges from U.S. News and World Report.

Of the 232 Catholic colleges and universities in the United States, UD is one of only 16 that rank as national universities.The University of Dayton offers a humanities-based general education program unparalleled among comprehensive universities of its size. It has been supported by several grants from the National Endowment for the Humanities, including grants to fund an alumni chair in the humanities and the humanities fellows.

**National Leader in Research and Service**

Situated in a city known for innovation and entrepreneurship, the University of Dayton enjoys a strong tradition of excellence in science, engineering and technology. Undergraduates have the opportunity to work closely with faculty on projects, including world-class research initiatives. The University of Dayton's graduate programs are designed with a focus on preparing graduate students to contribute to society through research and/or education. The Ph.D. programs in Biology and Electro-optics, as well as Master's Degree programs in Chemistry, Computer Science and Mathematics, are mentor-based and emphasize the honing of individual skills through faculty, graduate student/undergraduate student, university, community and societal interactions for positive growth towards the communication of scientific knowledge.

UD is committed to innovation and technology. All University-owned housing is fully wired for direct high-speed Internet connection.

The University has achieved a remarkable research record, thanks in large part to the University of Dayton Research Institute. UDRI, which performs $65 million of sponsored research annually, ranks first in Ohio and second in the nation in materials research funded by the federal government. Nationally, UDRI is the largest nonmedical research facility on a Catholic university campus.

The Templeton Foundation selected UD as having one of the nation's best service-learning programs that encourages students to contribute and learn through volunteer activity and as one of 100 colleges and universities in the United States that encourages character development and prepares students for lives of personal and civic responsibility.

UD was first in the country to offer an undergraduate degree program in human rights.

## NOTES

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Science Center Room 107
Kristina Mead - Presiding

# Poster Session A
# 9:00 – 10:00 AM

**Board 01 AQUACULTURE INITIATIVE PHASE II: LOCAL FEEDING STIMULANTS AND SUBSTITUTES FOR FRESHWATER PRAWN (*MACROBRACHIUM ROSENBERGII*) DIETS. Danielle T. Brzezinski, brzezi_d@denison.edu, Denison University, Granville OH 43023, (Jessica E. Rettig, rettig@denison.edu), Denison University, Dept of Biology, Thomas A. Evans, Denison University, Dept of Chemistry, David Swenson, Saginaw Valley State University, Dept of Chemistry.**

The Aquaculture Initiative began as an effort to eliminate the dumping of thermal wastewater from a local sugarbeet processor into the Saginaw River in mid-Michigan. The aim was to use the thermal wastewater to heat greenhouses, which contain tanks for growing freshwater prawn to be sold in regional markets. The aim of this study was to determine the effectiveness of local feed substitutes in place of commercial feed or stimulants in addition to commercial feed on the growth of freshwater prawns. Because feed constitutes over 50% of production costs, the use of local feeds may be an alternative that not only reduces cost but also maintains local interest and support. Five experimental diets were compared to a control diet over a seven-week period. Three of the diets used the feed substitutes soybean, dried distillers' grain with solubles (DDGS), or a 50:50 mixture of soybean:DDGS, while the other two used standard commercial feed plus betaine, a by-product of sugarbeet processing, or garlic juice (known feeding stimulants). The prawns were fed a feed mass of 7% of their average body weight based on weekly mass measurements. All diets, except the garlic stimulant and the soybean substitute, showed a greater average increase in percent body mass over the control. Examinations are being conducted on how the diet influenced growth over the course of the experiment. Currently, analyses are underway to assess cholesterol and glycogen concentrations in the prawn meat, to evaluate the effect of diet on meat quality.

**Board 03 SEASONAL CHANGES IN NEARSHORE AND OFFSHORE LAKE ERIE BACTERIAL ASSEMBLAGES: ANALYSIS USING FLOURESCENT *IN SITU* HYBRIDIZATION (FISH). Dana L. McDermott, dlmcderm@kent.edu, (Robert T. Heath, rheath@kent.edu), Dept of Biological Sciences, 256 Cunningham Hall, Kent State University, Kent OH 44242.**

Differences in community structure between nearshore and offshore bacterial assemblages in Lake Erie were examined using fluorescent *in situ* hybridization (FISH), monthly, from May through September 2005. Epilimnetic water triplicates of 11 nearshore and offshore sites were collected and preserved in formalin for later analysis. Bacterial taxa were visualized by attaching a fluorescent Texas Red label to the end of a complimentary RNA sequence bound to RNA. Fixed sample was filtered through 0.2um filters, probed, and observed under a Texas Red filter-set fluorescent microscope. Gamma proteobacteria percent composition varied throughout the summer (range: 0.145-4.75%). Gamma-proteobacteria numbers generally were greater at all sites than alpha- and beta-proteobacteria. Alpha proteobacteria comprised less than 2% of total bacteria at all sites, though numbers increased toward the end of the summer. Beta proteobacteria concentrations were highest at nearshore sites (range: 0.14-3.71%) in May and July and highest at offshore sites in June and September (range: 1.13-3.36%). Throughout the summer, the lowest alpha-, beta-, and gamma-proteobacteria values were observed in Sandusky Bay (less than 3% percent composition). These results suggest that bacterial community structure varies seasonally, possibly altering ecosystem function.

**Board 05 DIRECTIONAL QUANTIFICATION OF MACROINVERTEBRATES IN BIG WALNUT CREEK, OHIO, USA. Ben G. Van Allen, bgv2404@yahoo.com, (Michael A. Hoggarth, mhoggarth@otterbein.edu), Dept of Life and Earth Sciences, Otterbein College, Westerville OH 43081.**

The goal of this study was to determine if macroinvertebrates colonize substrate only by drift (flowing downstream in the current) or by other means. Knowledge concerning invertebrate dispersion in streams is needed to understand their ecology and evolution, and could help develop more accurate water quality testing methods. Macroinvertebrates are currently used to determine compliance with water quality standards. During this study, Hester-Dendy plates were used as bare substrate for macroinvertebrate colonization. Unmodified control plates were placed vertically in the stream. Experimental plates were modified by attaching a shield that blocked the plate from one direction. Each plate was positioned vertically by attaching it to a concrete block, which maintained its position and orientation in the flowing water. Two plates for each treatment (control, front-blocked, rear-blocked, and side-blocked) were attached to each cinder block. Two sets of cinder blocks were placed in Big Walnut Creek three times from 15 April to 15 October 2005. Each set of plates was in the water for a period of six weeks. Preliminary results suggest macroinvertebrates (other than Chironomidae) disproportionately colonize substrate from downstream and upstream. If the trend suggested by preliminary results holds true for the remainder of the study, it could mean that proper placement of Hester-Dendy plates requires consistency of orientation of the plates. It also may suggest that macroinvertebrates have adapted to life in flowing water by moving opposite to the direction of drift.

**Board 07 ZOOPLANKTON RESPONSES TO MANIPULATIONS OF FISH PREDATORS AND AMPHIBIAN COMPETITORS. Nicole R. Gray, gray_n@denison.edu, (Jessica E. Rettig, rettig@denison.edu), Geoffrey R. Smith, Denison University, Dept of Biology, Granville OH 43023.**

This study examines the response of zooplankton to an experimental manipulation of two different food webs containing fish and tadpoles. In the summer of 2004 we set up artificial pond communities in cattletanks (800 L) containing a gradient of tadpoles, American toads (*Bufo americanus*) or bullfrogs (*Rana catesbeiana*), at densities of 0, 25, 50, or 100 per tank. The amphibian treatment was crossed with the presence or absence of bluegill sunfish (*Lepomis macrochirus*). Bluegills are predators on zooplankton but also may cause tadpoles to modify their feeding behavior. In addition, tadpoles are potential competitors with zooplankton for algal resources. Tadpoles were added soon after hatching and each experiment lasted until the tadpoles began to metamorphose (American toads = 19 days; bullfrogs = 28 days). Zooplankton were sampled during the experiment to assess the direct and indirect effects that bluegill might have on them. The zooplankton community consisted of a mixture of taxa including *Daphnia*, *Bosmina*, copepods (cyclopoid and calanoid), and copepod nauplii. We are currently counting the zooplankton from the two experiments and will analyze the effect of treatments on total zooplankton abundance and the density of specific taxa.

**Board 09 GROWTH-LIMITATION BY PHOSPHORUS AND CARBON AT AN OFFSHORE STATION IN LAKE ERIE. James P. Hurley IV, jphurley@kent.edu, (Robert T. Heath, rheath@kent.edu), Kent State University, Dept. of Biological Sciences, Kent OH 44242.**

The purpose of this study was to determine whether natural bacterial assemblages collected from a station 16km offshore in the Sandusky Sub-basin of Lake Erie were growth limited by phosphorus, carbon, both, or neither. Samples were collected monthly and compared in July, August, and September of 2005. Bacterial assemblages were grown at ambient room temperature (23°C) in the dark, and growth was measured by increase in cell numbers and average cell biovolume at 0hrs, 24hrs, and 48hrs. The control was determined at t=0. Potassium phosphate and glucose were used as phosphorus and carbon sources, respectively. This study was performed using a factorial design of nine 250mL flasks with designations of "No", "Low" (80nM phosphate or 25µM glucose), and "High" (400nM phosphate or 125µM glucose) to represent concentrations of both phosphorus and carbon, respectively. Growth of bacterial assemblages was limited both by carbon and phosphorus availability, but predominantly carbon. This study was supported by grants from the NSF (UMEB-0305126) and Ohio Sea Grant College Program (R/ER-67).

**Board 11 BEHAVIORAL RESPONSES OF *PLETHODON CINEREUS* SALAMANDERS TOWARDS POTENTIAL COMPETITORS. Amber A. Burgett, burget_a@denison.edu, (Geoffrey R. Smith, smithg@denison.edu), Denison University, Slayter Box 418, Granville OH 43023.**

Centipedes and salamanders compete for resources including food and territory. Previous studies have shown that salamanders

respond with similar aggressive reactions when exposed to other salamanders and centipedes. Red backed salamanders, *Plethodon cinereus* should respond aggressively towards both conspecific and heterospecific (centipedes) competitors when exposed to chemical cues as well as the actual competitor. This study tests that hypothesis by exposing *P. cinereus* salamanders (n=52) to 4 treatments: their own substrate, a conspecific's substrate, a centipede's (*Scolopocryptops sexspinosus)* substrate, or a control substrate. By comparing differences in behaviors across treatments, the impact of a possible competitor's chemical cues on *P. cinereus* are determined. *P. cinereus* were also paired with another salamander (n=15) or a centipede (n=15) in a large Petri dish (15 X 300mm) lined with damp filter paper to test physical aggressiveness and behavior between interacting competitors. Trials occurred in either the focal salamander's container (which they resided in for 6 days prior) or in a "neutral" territory, which consisted of a new dish with dampened filter paper. Initial observations indicate that salamanders recognize and respond to the substrates of a control, of a different salamander and of a centipede more aggressively than their own substrate and chemical cues. Initial observations also indicate that *P. cinereus* reacts differently to conspecifics than it does towards centipedes, which is contrary to previous studies that show similar aggressive behaviors of *P. cinereus* towards conspecifics as well as centipedes because both are potential competitors.

**Board 13 EFFECT OF DOMINANCE ON SPACE USE IN CAPTIVE FEMALE GORILLAS. Katherine L. Theobald, theobaldkl@xavier.edu, (George Farnsworth, farnsworth@xavier.edu), Dept of Biology, Xavier University, 3800 Victory Parkway, Cincinnati OH 45207.**

Previous research on juvenile gorillas in a caged exhibit at the Cincinnati Zoo showed that juvenile gorillas limited their space use based on dominance and dominance was determined by weight. The present study investigated whether weight-based dominance would also be observed in a group of young females in a more naturalistic exhibit. It was hypothesized that juvenile females limit their space use according to dominance determined by weight with the largest limiting space use the most. The focus of the study was a group of three females, Mara, Chewie, and Shanta, approaching sexual maturity (8, 10, and 10 years old) in a naturalistic exhibit at the Cincinnati Zoo. The exhibit space was divided into uneven zones and the position of the three females was recorded every 30 seconds. More than 12 hours of observations were recorded, resulting in 1440 data points for each female gorilla. The data was analyzed using a modified spread of participation index (SPI) which evaluated whether use of space was evenly distributed. A value of 0 indicated use of only one zone and a value of 1 indicated even use of all the zones. The largest female by weight, Chewie, spent more than 65% of her time in one zone of the exhibit. Mara and Shanta, however, displayed a more even use of the exhibit zones. Observations show a limited use of space by the largest female indicating a weight-based dominance affecting space use.

**Board 15 EFFECTS OF PERINATAL POLYCHLORINATED BIPHENYL EXPOSURE ON THE DEVELOPMENT OF SOCIAL BEHAVIOR IN THE RAT. Maegan Horinek[1], hmaegan@bgsu.edu, Asia Johnson[1], johnsad@bgsu.edu, Logan McKnight[1], loganem@bgsu.edu, Christina Asbrock[1], casbroc@bgsu.edu, H.Casey Cromwell[2,3], hcc@bgsu.edu, Lee.A. Meserve[1,3], lmeserv@bgsu.edu, Depts of [1]Biological Sciences and [2]Psychology and the [3]J.P. Scott Center for Neuroscience, Mind and Behavior, Bowling Green State University, Bowling Green OH 43402.**

Polychlorinated biphenyl (PCB) ingested by pregnant mammals alters thyroid status, neurophysiological and cognitive function of the offspring. Less is known about development of social behavior after PCB exposure. This study compared the development of social behavior between control and PCB exposed young rats using established behavioral measurements. Mothers of control rats were fed regular chow and the diet of PCB-exposed rats contained 12.5 or 25.0 ppm of PCB (mixture of two congeners, PCB 47/77). Each group represents at least 5 litters of rats. Conditioned odor preference test measured the ability of two week-old rats to discern between a characteristic odor (lemon) associated with the mother or the same odor associated with a neutral stimulus; social interaction was estimated by observing play behavior in 30-50-day-old rats; and comparative social investigation by 60-day-old rats of an adjacent cage that contains a littermate was determined using the social port test. Analysis of variance was used to determine significant differences. Control animals exposed to mother-odor compound stimuli displayed a clear preference for the odor location 105 vs 92 sec.), while PCB-exposed pups showed a lack of preference for the odor location. Control animals showed typical levels of play , including dorsal contacts and pins (100/session). PCB-exposed animals showed a significant decrease in play behavior,. with impairment greatest after social isolation (40/session). PCB exposed rats spent more time (125 sec/5 min) exploring social ports than did controls (90 sec/5 min). These results will foster a greater understanding of how toxin exposure in early development can alter complex behaviors involved in social interaction.

**Board 17 UNDERSTANDING THE EVOLUTION OF THE DISEASE GENE, GLUCOSE-6-PHOSHATE DEHYDROGENASE (*G6PD*), WITH EMPHASIS ON THE EXON-INTRON STRUCTURE. Kevin P. Riehle, riehlekp@notes.udayton.edu, (Sudhindra R. Gadagkar, gadagkar@notes.udayton.edu), Dept of Biology, University of Dayton, Dayton OH 45469-2320.**

Mutations in the X-linked gene, glucose-6-phosphate dehydrogenase (*G6PD*), result in a deficiency in the enzyme of the same name in humans. This deficiency is a leading cause of hemolytic anemia, a condition where bone marrow activity cannot compensate for erythrocyte (red blood cell) loss. Although there is no known cure for G6PD deficiency, PCR-based methods for the detection of known mutations in *G6PD* make prenatal examination possible. The *G6PD* gene is at least a billion years old as it is seen in mammals as well as nematodes (minimum chordate-nematode divergence time = 1062 ± 81 million years). Consequently, there is also much diversity in the structure of this gene, with a wide range in the number of exons among different taxonomic groups. This project aims to understand the evolution of this gene, with an emphasis on the origin of novel exons and introns. Complete gene sequences with intron-exon structure have been collected from NCBI for six species, and more are being sought in order to obtain sequence data for at least one species per major taxonomic group so as to be able to reliably trace the evolution of the gene. Furthermore, the origin of exons and introns will be investigated by means of BLAST searches within the corresponding genomes where completely sequenced genomes are available. It is hoped that this investigation will further the understanding of this disease from an evolutionary perspective and will also help understand the mechanism of the genesis of novel exons and introns.

**Board 19 PLANKTONIC ABUNDANCE OF THREE FIDDLER CRABS (*UCA* SPP.) ALONG AN ESTUARINE GRADIENT NEAR BEAUFORT, NORTH CAROLINA: IMPLICATIONS FOR SETTLEMENT. Jena R. Buchhop, s07.jbuchhop@wittenberg.edu, (James M. Welch, jwelch@wittenberg.edu), Wittenberg University, Box 1812, PO Box 6100, Springfield OH 45501-6100.**

In the southeastern United States, there are three species of fiddler crab (*Uca pugilator*, *Uca pugnax*, and *Uca minax*) that different habitats: high salinity sand flats, moderate to high salinity salt marshes, and low to moderate salinity salt marshes, respectively. After offshore planktonic development, fiddler crab megalopae use selective tidal stream transport to move up the estuary to settlement sites. We hypothesize that *Uca pugilator* will selectively settle in high salinity areas, so that *Uca pugilator* megalopae will be less abundant farther up-estuary. In July 2005, plankton samples were collected just inside the Beaufort Inlet, at the entrance to the Carrot Island embayment (2 km up-estuary), and at Bell's Creek salt marsh (10 km up-estuary) with a 333-micron, 0.25-m diameter net during incoming tides at night. The samples were then sorted for *Uca* spp. megalopae. Because *Uca* spp. cannot be identified morphologically as megalopae, a PCR-RFLP analysis was used. The internally transcribed spacer region 1 gene (ITS-1) was amplified, digested with the restriction enzyme *Hpa*II, and the resulting fragments were separated using a 3% agarose gel. Initial results show a distribution evenly split among the three species at the mouth of the Newport River estuary, and to date, only *Uca pugnax* have been found in the plankton from the marsh, supporting our hypothesis.

**Board 21 SETTLEMENT OF FIDDLER CRABS *UCA* SPP. AT CARROT ISLAND, BEAUFORT, NORTH CAROLINA: SELECTIVE OR RANDOM? Rachel L. Allan, s06.rallan@wittenberg.edu, (James M. Welch, jwelch@wittenberg.edu), Wittenberg University, Box 3691, PO Box 6100, Springfield OH 45501.**

Three species of fiddler crabs commonly occur in the southeast United States. *Uca pugilator* is found in sandy, high-salinity areas, while *Uca pugnax* and *Uca minax* are found in salt marsh areas, of high to moderate salinity and moderate to low salinity, respectively. Carrot Island, near Beaufort, North Carolina, has a large, high-salinity intertidal sandflat with a dense monospecific population of *Uca pugilator*. This study examines whether this distribution is due to selective settlement by *Uca pugilator* or random settlement by all three species with post-settlement mortality or emigration of *Uca pugnax* and *Uca minax.* It is hypothesized that all settling megalopae found at Carrot Island will be *Uca pugilator*, indicating selective settlement. If species other than *Uca pugilator* are found, the hypothesis would be rejected and the distribution may be controlled by a post-settlement process. To distinguish between these alternatives, settling *Uca* spp. megalopae were collected and identified to species. Collectors were 0.25 $m^2$ squares of hog's hair filter material, which were exposed overnight and rinsed with fresh water to remove settled megalopae. Because fiddler crab megalopae cannot be identified to species by morphology, a PCR-RFLP technique was used. The ITS-I gene was amplified, digested with the enzyme *Hpa*II, and the resulting fragments separated using a 3% agarose gel. Initial genetic results show that of 33 settled megalopae, all are *U. pugilator*, supporting the hypothesis of selective settlement.

**Board 23 MICROARCHITECTURE OF THE CANINE ZONA PELLUCIDA. Matthew O. Lunn, lunnmato@notes.udayton.edu, Shirley J. Wright, University Of Dayton, Dept Of Biology, Dayton OH 45469-2320.**

Mammalian oocytes are surrounded by an extracellular matrix called the zona pellucida (ZP) that sperm penetrate and fertilize the oocyte. The structure and function of the ZP of model organisms has been well studied. Although ZP architecture is variable between species, it is generally consistent within species. Little is known about ZP ultrastructure of companion animals. The objective of the study was to elucidate ZP microarchitecture of the canine (*Canis familiaris*) oocyte by scanning electron microscopy (SEM). Over 200 oocytes were isolated from ovaries from more than 20 different dog breeds aged 6 months to 9 years. Oocytes were fixed, critical point dried and viewed by SEM. It was found that canine ZP ultrastructure was unexpectedly heterogeneous. Because of this, oocytes were placed into one of three groups based on their ZP appearance: Type I (N = 7), smooth ZP with no or few small (0.5 µm) pores; Type II (N = 122), fenestrated ZP with regularly spaced pores; and Type III (N = 108), rough and uneven ZP with irregular hollows and pores. The heterogeneous ZP morphology was independent of dog breed, age of donor, and maturity of the oocyte as reflected in oocyte size. When pores were present in the ZP, many were spherical or elliptical. Some pores were also conical and bifurcated into smaller pores that did not appear to completely penetrate through the ZP, suggesting that the ZP may prevent viruses, such as the canine distemper virus from penetrating the ZP and infecting the oocyte/embryo. Funded by the AKC Canine Health Foundation.

**Board 25 ARE SPECIES DISTRIBUTION OF FIDDLER CRABS *UCA* SPP. IN NORTH CAROLINA SALT MARSHES DETERMINED BY SELECTIVE SETTLEMENT OR POST-SETTLEMENT MORTALITY? Lenore A. Bamberger, s06.lbamberger@wittenberg.edu., (James M. Welch, jwelch@wittenberg.edu), Wittenberg University, Box 2329, P. O. Box 6100, Springfield OH 45501-6100.**

In the southeastern United States three species of fiddler crabs are present: *Uca minax*, *Uca pugilator*, and *Uca pugnax*, each in a particular habitat. *Uca minax* inhabits low to moderate salinity salt marshes and *Uca pugnax* lives in moderate to high salinity marshes. *Uca pugilator* prefers high salinity sites with sandy substrates such as sand flats. Bell's Creek salt marsh, an area of moderate salinity area near Beaufort, North Carolina, USA, is characteristically inhabited by equal adult populations of *Uca minax* and *Uca pugnax*. Few if any *Uca pugilator* are found here. In this experiment, megalopae were collected with hog's hair filter material and several dozen recently settled juveniles were collected with forceps. Megalopae and early juveniles of *Uca* spp. are indistinguishable morphologically, but a PCR-RFLP technique can be used to determine species. We amplified the ITS-1 gene, digested it with the restriction enzyme *Hpa*II, and separated the resulting fragments using a 3% agarose gel. This analysis results in species-specific banding patterns. If the species distribution of settlers is comparable to the adult population, we will conclude that *Uca* spp. might settle selectively, possibly using chemical cues from conspecific adults, sediment or other sources. If the species distribution is not comparable, then it is likely that the megalopae settle randomly and the adult population is determined by post-settlement processes such as emigration or mortality.

**Board 27 ACCUMULATION OF NFκB1 AND NFκB2 IS ESSENTIAL FOR APOPTOSIS INDUCED BY PROTEASOME INHIBITION IN A LYMPHOMA MODEL. Sarah K. Edwards[1], edwardsk@notes.udayton.edu, Leon Bernal-Mizrachi[2], Lee Ratner[2], [1]University of Dayton, Dept of Biology, Dayton OH 45469-2320, [2]Washington University School of Medicine, Section of Molecular Oncology, Division of Oncology, Dept of Internal Medicine, St. Louis MO.**

The proteasome is a novel target in the therapeutic approach of different subtypes of lymphomas. The proteasome degrades proteins involved in cell cycle progression and apoptosis and plays a central role in the equilibrium between anti-apoptotic signals derived from NFκB subunits p50 and p52, and tumor suppressor signals derived from the larger NFκB precursors p100 and p105. Our objective was to determine whether proteasome modulation of the tumor suppressor signals or anti-apoptotic signals is more important for the induction of apoptosis in lymphomas. We tested the apoptotic effect of proteasome inhibitor PS341 in two lymphoma cell lines after knocking down NFκB large subunit expression using lentivirus expressing siRNA's. After 24 hours of treatment, we measured apoptosis and NFκB inhibition by Annexin V-alexa fluorescent and NFκB luciferase reporter assays, respectively. Co-expression of siRNA against both p100 and p105 and selective knock down of each individual large precursor rendered cells resistant to the induction of apoptosis at clinical doses of PS341 (5 and 10 nM) compared to the controls. Western Blot analysis demonstrated much lower accumulation of p100 and p105 in the siRNA expressing cells as compared to controls. IκB, an NFκB inhibitor, remained stable or increased during treatment in the p105 and/or p100 siRNA expressing cell lines, despite the reduction in apoptosis. In conclusion, the current study demonstrates the essential role that the accumulation of the tumor suppressor forms of NFκB (p105 and p100), but not IκB, play in the induction of apoptosis produced by proteasome inhibition in a lymphoma model.

**Board 29 TOWARDS A STRAPPED PORPHYRIN LOGIC GATE. Rudy J. Wojtecki, wojteckirj@hiram.edu, (Colleen Fried, friedca@hiram.edu), Dept of Chemistry, Hiram College, 10096 Infirmary Rd., Mantua OH 44255.**

Short chain "basket handle" porphyrins (5,10,15,20-tetraphenyl-21H,23H porphyrin rings bearing alkoxy chans of 4,5, and 6-carbon atoms) will be synthesized. A salicylaldehyde derivative, containing a 6-carbon bridge, was first prepared then reacted with pyrrole. This will yield a mixture of porphyrins and polymerized pyrrole. These were separated by pressurized column chromatography. The reaction produces three "basket handle" porphyrin isomers that will, again, be separated, by column chromatography. This porphyrin will then be complexed with a zinc (II) ion, inserted into the porphyrin center, by dissolving the porphyrin in chloroform then adding a dilute solution of zinc(II) acetate dehydrate dropwise and allowing the reaction to come to completion. NMR will be used to characterize these compounds. The porphyrin's optical properties, determined with UV/Vis and FT/IR, and the dichromic properties of this molecule will be used to construct a logic gate. A logic gate will be assembled at a macroscopic scale with both dry crystalline porphyrins (grown by liquid diffusion) and wet 'porphyrin cells'. The conceptualized method is: focusing a polarized LASER on a porphyrin crystal, that will theoretically interact with the molecules and radiate light (of a shorter wavelength) at several angles transverse to the radiation source as well as refracting the incidental light. This emitted and refracted light could be captured on a position sensitive photo-detector. By placing crystals in an array, so that the emitted and refracted light of one crystal is perpendicular to another, a foundational operation of binary logic (AND, OR, or NOT) could be demonstrated. Variations of the crystals orientation and position could produce the other two essential operations of binary logic.

**Board 30 NANOLITHOGRAPHY USING ATOMIC FORCE MICROSCOPY. Rudy Wojtecki[1], wojteckirj@hiram.edu, Kristian Molhave[2], krm@mic.dtu.dk, [1]Dept of Chemistry, Hiram College, 10096 Infirmary Rd., Mantua OH 44255, [2]Centre for Micro- and Nanotechnological Research, Danish Technical University, Denmark.**

Atomic force microscopy (AFM) was used to fabricate a variety of controlled nanostructures by three methods: (1) Voltage-pulse

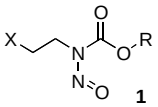
(anodic oxidation), (2) a Set-z method, in which the AFM cantilever remains at a constant height, and (3) Set-point, where the cantilever remains at a constant pressure. A variety of structures were produced by all three methods: lines, grids, spirals, circles, and single dot depressions. (1) involves the application of a positive voltage to a substrate surface with respect to the tip in an ambient environment. This method was applied to two variations of a silicon substrate (i) with a native oxide layer and (ii) a hydrogen passivated surface. Oxidation patterns were visually more well defined with a hydrogen passivated surface as compared to the surface with a native oxide layer. This allowed for smaller and qualitatively cleaner oxidation patterns. (2) was used to 'scrape' patterns on a thin layer of PMMA. This yielded rough edged patterns with circular indentations at the structurer's boundaries. This method was used to make a pattern on 50nm film of PMMA on silicon. After this lithography procedure aluminum was deposited on the surface with Alcatel e-beam metal evaporation system. The PMMA and aluminum, in contact with the PMMA, was lifted off with acetone. This procedure demonstrated the application of AFM for the fabrication of nanostructures.

### Board 31 SYNTHESIS AND CHARACTERIZATION OF TCNQF$_4$ CHARGE TRANSFER COMPLEX WITH OCTAMETHYLBIPHENYLENE. Erica L. Booth, ebooth@muskingum.edu, (Raymond D. Rataiczak, ray@muskingum.edu), 163 Stormont Street, New Concord OH 43762.

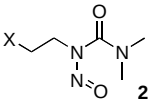
Since the discovery of organic superconductors in 1979, extensive research has gone into identifying and studying organic materials made up of electron donor-acceptor complexes. Previously, a charge transfer complex was formed from tetracyanoquinodimethane, TCNQ, and octamethylbiphenylene that resulted in a 50% charge transfer to the TCNQ, which was determined from the 2pm bond elongation of the octamethylbiphenylene in the charge transfer complex with TCNQ. The goal of this research is to synthesize a charge transfer complex from the strong pi-electron acceptor 2,3,5,6-tetrafluoro-7,7,8,8-tetracyanoquinodimethane, TCNQF$_4$, and the electron donor octamethylbiphenylene. The resulting charge transfer complex's structure and physical properties will be elucidated using infrared spectroscopy, UV-Visible spectroscopy, nuclear magnetic resonance spectrometry, and single crystal X-ray diffraction.

### Board 33 PREPARATION, CHARACTERIZATION AND DFT STUDIES OF SOME NEW N-NITROSO CARBAMATES AND N-NITROSOUREAS. Ragavan Narayanan, narayarz@notes.udayton.edu, Helene Hedian, Eric Shamo and Vladimir Benin, Dept of Chemistry, University of Dayton, Dayton OH 45469-2357.

We are presenting the preparation, characterization and density functional theory (DFT) studies (*B3LYP/6-31+G(d)*) of several related classes of N-nitrosocarbamates and N-nitrosoureas, whose general structures are shown below. The long-range goal is the design and preparation of compounds, which would undergo photochemical or hydrolytic decomposition, to yield stabilized cyclic cations that can serve as alkylating agents at various nucleophilic centers, including DNA bases.



**1**



**2**

R = $ArCH_2$, Et
**a**: X = Cl
**b**: X = $CH_3S$
**c**: X = $(CH_3)_2N$

Carbamates 1a have been prepared by reaction of 2-chloroethyl isocyanate with the corresponding alcohols. Carbamates 1b and 1c were synthesized *via* interaction of 2-(methylthio)ethyl amine or 2-(dimethylamino)ethyl amine with the corresponding chloroformates, while ureas 2b and 2c were prepared by reactions of those amines with carbamoyl chloride. Structures of all compounds 1 and 2 have been confirmed, including preliminary X-ray crystallographic data for compounds 1c. Carbamates 1c and urea 2c are isolated in the form of their hydrochloric salts, rendering them soluble in aqueous medium. DFT calculations were used to locate and optimize minima and transition states on the decomposition pathways. Calculations, in each of the studied cases, locate the corresponding cyclic intermediate (chloronium, sulfonium or ammonium cation) as a distinct minimum on the potential energy surface. The exothermicity of intermediate formation increases in the order chloronium < sulfonium < ammonium cation. In conclusion, we have prepared new compounds, belonging to several related classes of N-nitroso carbamates and N-nitrosoureas. The identity of the target structures has been confirmed by standard physical methods, with preliminary X-ray data on the tetrafluoroborate salt of 1c. DFT studies demonstrate that each of these structures does indeed decompose to yield a cyclic cationic intermediate.

### Board 35 INFORMATION ASSURANCE THROUGH BINARY VULNERABILITY AUDITING. William B, Kimball, kimbalwb@notes.udayton.edu, (Saverio Perugini, saverio@udayton.edu), 1162 Abbott Rd., Batavia OH 45103.

The goal of this research is to develop improved methods of discovering vulnerabilities in software. A large volume of software, from the most frequently used programs on a desktop computer, such as web browsers, e-mail programs, and word processing applications, to mission-critical services for the space shuttle, is unintentionally vulnerable to attacks and thus insecure. By seeking to improve the identification of vulnerabilities in software, the security community can save the time and money necessary to restore compromised computer systems. In addition, this research is imperative to activities of national security such as counter-terrorism. The current approach involves a systematic and complete analysis of the low-level organization of software systems in stark contrast to existing approaches which are either ad-hoc or unable to identify all buffer overflow vulnerabilities. The scope of this project is to develop techniques for identifying buffer overflows in closed-source software where only the software's executable code is available. These techniques use a comprehensive analysis of the software system's flow of execution called binary vulnerability auditing. Techniques for binary vulnerability auditing are grounded in science and, while unproven, are more complete than traditional ad-hoc approaches. Since there are several attack vectors in software, this research will focus on buffer overflows, the most common class of vulnerability.

### Board 37 GENAV: A GRAMMATICAL EVOULUTION SYSTEM FOR ROBOT NAVIGATION. Scott D. Reynolds, reynolsd@notes.udayton.edu, (Jennifer Seitzer, Jennifer.Seitzer@notes.udayton.edu), University of Dayton, 300 College Park, Dayton OH 45409.

Grammatical Evolution is a method of machine generating computer programs of any arbitrary computer language, so long as that language has an associated Backus-Naur From (BNF) grammar. Our system, *Grammatically Evolved Navigation* (GENAV), uses the method of Grammatical Evolution to generate a robot control program that implements the boundary navigation problem. Using the OOPic® micro controller, and the BNF of its control language (a diminutive form of the C++ programming language) as input, the GENAV system evolves an optimal program for the task of boundary navigation of the Botster robot. One iteration of a typical evolutionary system operates on a current generation of possible solutions, assesses the fitness (merit) of each solution, and then selects one of the solutions in the group to continue on for the next iteration and to produce offspring. One unique aspect of the GENAV system, is the active participation of the robot during all three phases of this algorithm. Using the robot's on board processor and PC/104 board with a wireless connection to the desktop part of the GENAV system, the robot executes and thus demonstrates the efficacy of each possible solution as it is generated.

### Board 39 SYNTHESIS OF TASK-SPECIFIC ROBOTIC WRISTS. Eric M Grimm, grimmerm@notes.udayton.edu, Andrew P. Murray, andrew.murray@notes.udayton.edu,1017 Yorkshire Place, Dayton OH 45419.

A spherical four-bar mechanism has four revolute joints, or hinges, whose axes of rotation intersect at a single point in space. Due to this common point of intersection, the spherical four-bar mechanism is useful for reorientation actions only. A coupler-driven spherical four-bar mechanism, or CDs4R, adds to the four-bar a length-changing leg that drives one of the links in the mechanism directly. Specifically, the length-changing leg is attached via ball joints to a fixed location in space at one end and to the coupler (the outermost link of the spherical mechanism) at the other. This length-changing leg moves the mechanism by applying a force to the coupler directly along the line of action defined by the current locations of the ball joints. A CDs4R may be synthesized to achieve a finite number of designer-specified orientations. The capabilities of a CDs4R stand in contrast to the capabilities of a robot wrist may produce any orientation. In many applications, however, robot wrists are used to move between only two or three distinct orientations. Hence, robot wrists are a far more sophisticated piece of machinery than needed by many manufacturing processes. Moreover, in high-speed

assembly or the manufacture of large volumes of parts, a CDs4R device designed to meet the exact demands of a process will be faster, more accurate, and consume less energy. If successful in practice, these devices present an intriguing new and cost-effective option to industrial users of robot wrists. The research challenge is to generate a methodology by which a designer can specify a desired number of orientations and produce the kinematic parameters of a CDs4R that achieves these orientations. The method utilized was to generate the equations that express the relationships between the kinematic parameters of a CDs4R and the orientations it achieves. Then, these equations were manipulated to produce relationships critical to allowing a designer to solve them via an interactive software tool. The result is a design methodology and corresponding software tool to perform the kinematic synthesis of the CDs4R. The software tool was developed in the Matlab™ environment and aids the designer in the graphical specification of problems and the generation, viewing, and evaluating of the CDs4R mechanisms that solve them.

**Board 41 DESIGN A NOVEL BROADBAND LEAKY WAVE ANTENNA. Hai Jiang, jianghaz@notes.udayton.edu, Krishna M. Pasala, krishna.pasala@notes.udayton.edu, University of Dayton, Dept of Electrical Engineering, Dayton OH 45469.**

For many air-borne applications, such as in Avionics, it is advantageous to have antennas which are light-weight, have a low profile and high bandwidth. It is also desirable for these antennas to be capable of low-angle radiation, towards horizon. Printed leaky wave antennas meet these requirements and are considered here. The specific configuration consists of an open microstrip excited asymmetrically to realize the first higher mode and was discussed first by Menzel. This can also be realized in "half-width" configuration and was considered by Zelinsky, who used the Finite Difference Time Domain (FDTD) approach to analyze this antenna. In the present work, analytical expressions are derived for the propagation constant and the fields in microstrip and the Finite Elements (FE) method is used as a tool to validate the theory. The agreement between theoretical and simulated results is on the order of 5%. The theory is used to determine analytical expressions for the wave and driving point impedances. The calculated driving point impedance may be used to terminate the antenna to absorb the residual power and minimize the reflections. The FE approach is especially suitable to simulate and analyze inhomogeneous dielectric structures. It is demonstrated that by periodically loading the microstrip line with air gaps and keeping the period much less than a single wavelength, it is possible to control the characteristics of the leaky wave mode to realize a leaky wave antenna whose band-width is increased by a factor of 50% or more compared to the homogeneous substrate antenna while leaving the pattern characteristics essentially unchanged.

**Board 43 DETERMINING RELATIVE CONTRIBUTIONS TO THE VOLUME SWELL OF FLUOROSILICONE O-RINGS BY SPECIFIC SPECIES IN A COMPLEX MIXTURE. Chad M. Huelsman, huelsmcm@notes.udayton.edu, (John L. Graham, grahamjl@udri.udayton.edu), Energy and Environmental Engineering Group, Research Institute, Kettering Laboratories, Rm. 102, University of Dayton, 300 College Park, Dayton OH 45469-0114.**

Volume swell due to neat model penetrants is often assessed by using weight change or volume change by way of water displacement as a measure of solvent uptake. However, in complex mixtures such as jet fuel, these methods do not provide information on the relative contribution to the volume swell by specific species or compound classes. The purpose of this study is to determine if gas chromatography-mass spectrometry (GC-MS) can be used to quantify the uptake of specific species from a complex mixture to determine the relative contributions of each species to the overall volume swell. It is hypothesized that the volume change of an o-ring immersed in a complex fluid will be the sum of the volumes of the individual species absorbed. To test this hypothesis, samples of a fluorosilicone o-ring material (Parker L1120) will be immersed in a mixture at room temperature containing a series of normal alkanes from nonane to hexadecane (80%v/v) and a series of normal aromatics from ethyl benzene to pentyl benzene (20%v/v). This mixture will simulate the major compound classes found in jet fuel. The volume change of the o-rings will be measured using method ASTM-D471 until the samples are at equilibrium. The solvent uptake will then be measured using direct thermal desorption GC-MS in conjunction with prepared standards of the mixture components. From the GC-MS analysis and the density of the penetrants the volume occupied by each penetrant will be calculated. The total penetrant volume will be compared with the measured volume change. Additionally, the relative contribution of each penetrant to the volume change will be reported.

**Board 47 EFFECT OF FUNCTIONALIZED $TiO_2$ NANOPARTICLES ON CELLULAR APOPTOSIS AND FORMATION OF REACTIVE OXYGEN SPECIES. Jeff Calhoun[1], calhoujd@notes.udayton.edu, Mike Check[2], checkmih@notes.udayton, Melanie Tomczak[3], mtomczak@ues.com, Elmo Blubaugh[4], Elmo.Blubaugh@udri.udayton.edu, Jay Johnson[4], Jay.Johnson@udri.udayton.edu, (Marie-Claude Hofmann[1], Marie-Claude.Hofmann@notes.udayton.edu), [1]Dept of Biology, The University of Dayton, [2]Dept of Chemical Engineering, The University of Dayton, [3]UES, Inc, [4]University of Dayton Research Institute, 300 College Park, Dayton OH 45469-2320.**

Recently, nanoparticles have received enormous attention to create novel analytical tools for biotechnology and the life sciences. The purpose of this study was to analyze the cytotoxicity of functionalized $TiO_2$ nanoparticles. These particles are thirty nanometers in diameter and have been created to modulate signaling pathways in the male germ line depending on their photoactivation. Previous data from our lab have shown that these nanoparticles do not affect cell viability, membrane integrity or mitochondrial function. However, a more thorough cytotoxicity analysis is necessary since events such as the first steps of apoptosis and the formation of reactive oxygen species within cells are not readily visible. We used the germline stem cell line C18-4 as a mouse model for these studies. For the apoptosis assay, the cells were cultured to 70% confluency, and functionalized $TiO_2$ nanoparticles were added to the cultures at concentrations of 0.0, 0.5 and 1.0 µg/ml in triplicates. After 24 h incubation, the cells were washed three times in cold PBS and analyzed using two fluorescent dyes. The YO-PRO-1 dye selectively passes through the plasma membrane of apoptotic cells and labels their nuclei with green fluorescence. The nuclei of necrotic cells are stained red-fluorescent with propidium iodide. Cells were assessed with an inverted fluorescence microscope, and a minimum of 500 cells counted per sample. Our data show that the nanoparticles do not induce apoptosis before or after photoactivation. Further assays are underway to analyze the effects of activated nanoparticles on the intracellular formation of reactive oxygen species.

**Board 49 EQUIVALENT CIRCUIT MODEL OF AN ELECTRICAL IMPEDANCE SYSTEM FOR COMPUTING MULTIPLE PARAMETERS. Ajay B Siddoju[1], siddojab@notes.udayton.edu; Shamachary Sathish[2], shamachary.sathish@wpafb.af.mil; Address : Caldwell Street Center, 300 College Park Ave, University of Dayton, Dayton OH 45469; [1]Dept of Electrical Engineering, University of Dayton OH 45469, [2]University of Dayton Research Institute, Dayton OH 45469.**

Electrical impedance measurement systems are widely used in a variety of materials, biological tissue and chemical analysis applications. Electrical Impedance system, like an Eddy current instrument used to measure conductivity of metals is severely affected by noise due to changes in electrical characteristics of cable, sensor and cable-sensor coupling for measurements above 500 KHz. Although frequent calibration of instrument using standard test samples increases the reliability of experimental results, there is no valid procedure to determine and compare major noise contributing parameters. An equivalent circuit model of an Eddy current instrument based on HP8753D network analyzer with a frequency range of 30 KHz -3 GHz was developed using commercial software Pspice® and Matlab®. The instrument parameters like physical length of cable, impedance characteristics of cable, sensor and properties of test material are used to simulate the frequency response of impedance and power. The comparison of frequency responses of power in range 30 KHz – 10 MHz, obtained from the model simulation and the experiment using network analyzer, 50Ω cable of 1m length, 100µH inductive sensor without any test sample revealed similarities of peak at 100 KHz and minimum at 10 MHz. The noise contributing parameters like slight changes in length, impedance of cable and sensor due to different test conditions are simulated by varying the values individually to determine major noise contributing parameters in each case. The analysis of major noise parameters revealed the frequency dependent characteristics in sweep frequency response. The frequency dependent conductivity and noise parameters give an alternative way to identify noise contributing parameters during experiments.

**Board 51 SOLID-STATE NMR CHARACTERIZATION OF LANTHANIDE ACETYLACETONATES. Janet H. Gaba, janet.gaba@otterbein.edu, (Joseph R. Sachleben, jsachleben@otterbein.edu), Chemistry Dept, Otterbein College, Westerville OH 43081.**

Samarium acetylacetonate, $Sm(acac)_3$, and yttrium acetylacetonate, $Y(acac)_3$, were analyzed by solid-state $^{13}C$ nuclear magnetic resonance (NMR) spectroscopy in order to assess the effects of paramagnetism and crystallinity on the NMR spectrum. $Sm(acac)_3$ and $Y(acac)_3$ were obtained from Alfa Aesar and were recrystallized from a 60/40 ethanol/water solution. Crystals thus obtained were studied by cross polarization magic angle spinning (CPMAS) on a Bruker DMX 400 MHz NMR spectrometer operating at a $^{13}C$ frequency of 100.63 MHz. It was expected that the peak widths of the unrecrystallized compounds' spectra would be wider than those of the recrystallized compounds, and that the peaks of the $Y(acac)_3$ spectrum would be narrower than those of $Sm(acac)_3$. Spectral comparisons support the conclusion that highly crystalline samples provide significantly improved NMR spectra that can then be used for structural analysis. Next, we intend to test 90/10 mole percent $Y/Sm(acac)_3$ mixed crystals. With the samarium atoms isolated, the effects on carbon atoms will be due primarily to one samarium atom instead of many. Future multidimensional NMR experiments will allow the extraction of paramagnetic shifts from these spectra which are related to the distance between the paramagnetic metal and the nucleus under study.

**Board 53 KINEMATIC SYNTHESIS OF PLANAR PLATFORM MANIPULATORS. Suresh K Akepati akepatsk@notes.udayton.edu , Andrew P. Murray, andrew.murray@notes.udayton.edu, 903 Wilmington Ave, Apt#301, Dayton OH-45420.**

The goal of this research is to develop a methodology for the kinematic synthesis of planar robots or, more generally, planar chains composed of revolute and prismatic joints. Successful kinematic synthesis identifies the joint locations, joint types, and number of links in a chain such that a desired workspace is reachable by the chain. A workspace specifies the desired capabilities of a planar chain without specifying the chain itself. A simple kinematic synthesis problem, for example, is to find the dimensions of a planar chain (of rigid bodies) connected by three revolute joints that can move a body to any location in workspace that is a 24 inch by 30 inch rectangle while able to rotate it anywhere from -20º to +30º inside the rectangle. Particularly useful kinematic synthesis methodologies allow a designer to specify limitations on the sizes of components in the chain, on the capabilities of the joints in the chain and leave open the capacity to design additional chains to create a different class of robots called platform manipulators. Platform manipulators are of interest because they are currently under investigation for a wide variety of applications due to their potential higher speeds, stiffness and accuracy when compared to more traditional robotics. An additional challenge worthy of note is that many kinematic synthesis techniques rely on designer intuition and a variety of brute force procedures. Due to the nonlinear relationships between the parameters used in kinematic synthesis and the chain's workspace, this brute force approach results in difficulty for the designer due to the inability to straightforwardly connect the parameters and the workspace. The method utilized to develop a kinematic synthesis technique is to analyze the set of design equations capable of being applied to any planar chain consisting of revolute and prismatic joints.

**Board 55 EFFECT OF MACHINE VARIATION ON END EFFECTOR POSITION FOR A SPHERICAL FOUR-BAR David A. Perkins, perkindz@notes.udayton.edu, Michael Turner PhD., Michael.Turner@notes.udayton.edu, University of Dayton, 303 W. Monument Ave, Dayton OH 45402.**

The objective of this research was to investigate the effect errors in the fabrication of the links have on the motion of a spherical four-bar mechanism (s4R). While these mechanisms have been examined in theory, little effort has been made to apply them practically. A spherical four-bar is a kinematic linkage with a single degree-of-freedom, allowing for a single motor attached to the input link to drive the mechanism and achieve spatial motion and orientation. The axes of the revolute pivots between the links intersect at a common point causing the links to move along the surfaces of concentric spheres. The fabrication of any mechanism has errors within certain tolerances, but it is unknown how this affects the displacement and orientation of its parts. To determine this, an error was assumed in the spherical angles of the links that still allowed the joint axes to intersect at a common point. As a result, the mechanism was still a functioning s4R linkage, albeit a different one. The objective of this study was to determine how tightly the tolerances for the fabrication of the links should be held to maintain a given end effector position and range of motion. An error of 1-degree for each link angle was assumed as the worst case scenario for this tolerance study as this error corresponded to a machining error of 0.005". This is a normally attainable tolerance for modern machine fabrication purposes. Using solid modeling within the Pro-E™ and SolidWorks™ software packages and mathematical simulations in MATLAB™, 30000 different link angle combinations were chosen at random and their susceptibility to errors were analyzed by comparing the original motion to the motion of the same mechanism with errors in the links. Through these simulations was determined that the probability of a larger error corresponded inversely with a mathematical formulation known as the T-Conditions. These conditions are calculated from the link angles and determine how closely the mechanism operates to a folding condition singularity. Away from these conditions, the errors are relatively small and within the allowable tolerance. Through additional simulation it was found that if the axes did not intersect at a common point, that motion was still possible so long as the three non-input revolute joints became cylindrical joints, creating an R3C mechanism.

**Board 57 BEAVER (CASTOR CANADENSIS) HERBIVORY EFFECTS ON AN ANTHROPOGENICALLY ALTERED LANCSCAPE. Paul Hughes, phughes@muskingum.edu, (James L. Dooley, jdooley@muskingum.edu), Conservation Science Program, Muskingum College, 163 Stormont St., New Concord OH 43762.**

Beaver (*Castor canadensis*) have been referred to as ecosystem engineers, meaning that they greatly alter their environment. Beaver are able to affect species diversity and richness through their harvesting of woody plants. The goal of this study is to access the impact of beaver foraging on forest systems across the heavily altered landscape of the Wilds (in Muskingum county, Ohio). Prior to the establishment of the Wilds in the 1990s, this ecosystem was drastically altered by strip mining. Vegetation transects were established at sites currently used by beaver as well as at abandoned beaver sites. Tree species diversity was found to be low, and highly dominated by Autumn Olive and Sweetgum. Variables recorded were plant species composition as well as recruitment data in each of four subplots for nine transects across three sites. Descriptive statistical analysis will be used to compare patterns of foraging activity and plant community impacts within and between sites. Within site analyses will include comparisons of response variables as a function of distance from water. Comparisons of currently active with abandoned areas should provide insights as to longer-term impacts of beaver foraging. Results from this study may provide important insights to develop a beaver management plan for the Wilds.

**Board 59 PLETHODONTID SALAMANDER POPULATION DENSITIES AS INDICATORS OF HABITAT HEALTH. Brandon D. Hartman, bhartman@muskingum.edu, (James L. Dooley, jdooley@muskingum.edu.), Muskingum College, Conservation Science Program, 163 Stormont St., New Concord OH 43762.**

According to several studies, plethodontid salamander populations have been slowly declining over the past several years. Environmental stressors can directly or indirectly affect both the species and the habitat by interfering with the biological community's ability to function properly. Salamander populations are influenced by several elements in their environment that include: soil moisture and humidity, the abundance of cover, the depth of leaf litter, the amount of organic material in the soil and the temperature on the forest floor. Plethodontid salamander populations may play an important role in processing nutrients for forest growth and productivity making them useful in evaluating ecosystem health. In addition they are known to have an important role in maintaining ecosystem integrity because they are likely to respond to changes in the environment more quickly than other forest amphibians. The study was conducted in a hollow, located on private property in White Cottage, Ohio in Muskingum County during the month of May 2005. The objective was to investigate the use of cover and other habitat features by plethodont salamanders. While studying the use of cover objects, we also investigated the role of moisture in habitat selection of a plethodontid population. When observing the two sites we found that in site A the leaf liter depth was found to be more abundant cover for salamander species (.7452 ± 0.0859 vs. 0.4837 ± .1082). In site B the tree diversity and diameter at breast height was higher (2±0.731 vs. 11.198±4.54). There was a significant difference in pH levels between site A and site B (5.97±0.24 vs. 5.71 ± 0.26).

**Board 61 DEVELOPMENT OF A LAND USE MODEL FOR THE CONSERVATION BIOLOGY OF MOLE SALAMANDERS (*AMBYSTOMA*) IN THE TILL PLAINS OF WESTERN OHIO. Elizabeth A. Rhoads, rhoadsea@notes.udayton.edu, P. Kelly Williams, kelly.williams@notes.udayton.edu, University of Dayton, Biology Dept, 300 College Park, Dayton OH 45469-2320.**

The Till Plains Region is dominated by agriculture and contains numerous isolated wet woodlots. Six species of mole salamanders (*Ambystoma*) breed in woodland vernal pools in this region. These salamanders require both aquatic and upland habitat, and have experienced decline due to wetland drainage and deforestation. This study assessed salamander breeding sites to develop a model that correlates landscape characteristics with salamander presence in order to aid conservation efforts. Through analysis of known breeding sites, salamander presence at unknown sites was predicted using habitat characteristics. Fifty sites from fifteen counties in western Ohio were sampled for larvae and landscape variables in 2004 (known sites) and 2005 (unknown sites). Larvae were captured with dip nets and preserved for identification. Global positioning system points were recorded and additional landscape data was obtained using GIS applications. Four species (*A. maculatum*, *A. texanum*, *A. tigrinum*, *A. jeffersonianum* complex) were found across thirty-four sites (N = 415). Salamanders were present at all known sites and 62% of previously unknown sites. In 2005, 80% of pools within or adjacent to forest and 17% of unforested pools contained larvae. Chemically, pH for sites with salamanders ranged from 6.95-8.14 in 2004 and 7.21-8.11 in 2005, and 7.39-8.46 in 2005 sites without salamanders. Average percent open water for sites with salamanders was 33% in 2004 and 52% in 2005, and 66% in 2005 sites without salamanders. The best predictor of salamander presence in this region was forest cover associated with the breeding pool.

**Board 63 BEHAVIORAL TESTS OF AN INTRODUCED POPULATION OF THREESPINE STICKLEBACK (GASTEROSTEUS ACULEATUS) IN LAKE MICHIGAN. Jeffrey A. Jackson, jjackson@muskingum.edu, (James L. Dooley, jdooley@muskingum.edu), Conservation Science Program, Muskingum College, 163 Stormont Street, New Concord OH 43762.**

Within the past 20 years threespine stickleback (Gasterosteus aculeatus) have invaded the Great Lakes. Although several papers document the appearance and migration of this fish, there are no studies on their behavior in this new environment. This study was designed to compare differences in reactions to dummy conspecifics by male stickleback. The population of Lake Michigan stickleback most likely originated from an Atlantic population via the St. Lawrence Seaway. Tests were run on 18 males collected from Trail Creek in Michigan City, IN during June of 2004 and documented their reaction to dummies of conspecifics. Responses were compared to data from a population from Long Island (N=20), which is postulated to be where the Lake Michigan population originated. Paired T-tests were used along with wilcoxon signed rank tests to determine any significant difference between behaviors within the Lake Michigan population. The majority of courting behavior by males was directed to dummy females than dummy males ($t = -2.942$, d.f. = 17, $p < 0.01$) and attacks directed to the dummy males was greater than dummy females ($w = -69.0$, N = 18, $p = 0.109$). In general, the Long Island fish responded more frequently than the Lake Michigan population with significant differences in both bites to the male stimuli ($t = 259.0$, $n = 20$, $p < 0.01$) and courting behaviors to the female stimuli ($t = 227.0$, $n = 20$, $p < 0.001$). Further testing should be conducted to determine what factors caused the differences in behavior that were observed between the two populations.

**Board 65 MONARCH BUTERFLY LARVA (*DANAUS PLEXIPPUS*) DISPERSAL EFFECTS ON AN ANTHROPOGENICALLY ALTERED LANDSCAPE. Rebecca Showalter, rshowalt@muskingum.edu, (James L. Dooley, jdooley@muskingum.edu), Conservation Science Program, Muskingum College, 163 Stormont St., New Concord OH 43762.**

Monarch butterflies (*Danaus plexippus*) are bioindicators; their population performance may reflect the overall health of the ecosystem they inhabit. In addition, a number of studies have indicated that the relative abundance of monarch butterflies may reflect important cues about the composition of plants within the local communities. The study included fifteen distinct habitat patches containing monarch butterflies across the heavily altered landscape of the Wilds in Muskingum and Guernsey County, Ohio. Prior to the establishment of the Wilds in the 1990s, this ecosystem was drastically altered by strip mining. Plots were established at sites containing at least one of three different types of milkweed (common milkweed (*Asclepias syriaca*)(n=296), swamp milkweed (*Asclepias incarnata*)(n=622), and orange milkweed (*Asclepias lanceolata*)(n=1)). The types and relative composition of different milkweed species found in each patch were recorded as well as the number of the number monarch butterfly (*Danaus plexippus*) eggs (n=175), and the number of larvae(n=92). The larva was observed from September 11 2005 to October 7 2005. Comparisons across distinct habitat patches should provide important insights that will enhance understanding of ecosystem recovery as well as the ecology of monarch butterflies. The results of this study may provide important insights to develop a monarch butterfly management plan for the Wilds.

**Board 67 HABITAT SELECTION OF NESTING BLUEBIRDS *(SIALIA SIALIS)* IN HOMOGENOUS HABITAT AT TANNENHAUF GOLF CLUB IN NORTHEASTERN OHIO. Emily R. Snode, esnode@muskingum.edu, (James L. Dooley, jdooley@muskingum.edu), Conservation Science Program, Muskingum College, 163 Stormont St., New Concord OH 43762.**

Over the past 50 years, there has been increasing concern over the decline of Eastern bluebird (*Sialia sialis*) populations. Biologists have calculated that eastern bluebird populations may have declined by as much as 90 percent, possibly due to the combination of competition for nest sites, decline of nest cavities due to human agriculture practices, climate change, pesticide use, and food supply decline. It has been demonstrated that bluebirds generally prefer and are more successful in open areas with sparse ground cover and short grass relative to areas of denser tree and ground cover. In this study, the objective was to assess whether bluebirds demonstrate fine-grained habitat selection within an open landscape that features only attributes that coarser comparisons have suggested as favorable (e.g., low tree density and short ground vegetation). A total of 35 nest boxes were studied May 2005 through August 2005 at Tannenhauf Golf Club in Alliance, Ohio. The total number of: bluebird occupants, eggs, nestlings, and fledglings were recorded at each nest box. In addition, we recorded whether the nest box was usurped by another cavity nesting species. Distance to the nearest tree, building, and body of water were recorded, as were the number of trees within 50 meters of the nest-site, and the percentage of vegetation within 3 meters of nest-site. One-way ANOVA analyses will be run on using the number of bluebird occupants, eggs, nestlings, and fledglings as dependent (response variables) while habitat variables will be analyzed as independent variables. Results from this more fine-tuned investigation into habitat associations may allow biologists to develop more detailed recommendations for eastern bluebird management.

**Board 69 THE EFFECTS OF A RECLAIMED STRIP MINES' HABITAT ON THE AMERICAN KESTREL, *FALCO SPARVERIUS*. Daniel M. Hollenbaugh, danielh@muskingum.edu, (Jim Dooley, jdooley@muskingum.edu), Muskingum College, Conservation Science Program, 163 Stormont St., New Concord OH 43762.**

American kestrels, *Falco sparverius*, are raptors that prey upon amphibians, reptiles, small mammals, passerine birds, annelids, and arthropods. They live in agricultural areas, open fields, cities, wood edges, or dead trees. The purpose of this research project was to examine the extent to which habitat alteration affected nest site selection and reproductive success. The hypothesis of this study is that if ground cover is abundant, kestrels will occupy nest boxes at a higher rate because there may be more prey available. The location of the study was at the Wilds, a reclaimed strip mine located in Cumberland, Ohio. Sixteen nest boxes were established across a variety of sites within the largely grassland landscape. The nest boxes were observed to see whether or not kestrels occupied them based on a habitat analysis of vegetation surrounding them. The environments were surveyed by forming a five meter radius around the nest box area, by taking measurements of the plants, by determining the amount of ground cover, and by identifying the different species of trees surrounding the nest boxes. The average percent ground cover was the same for unoccupied and occupied nest boxes ( $\chi$ = 58.57% ± 14.67 vs. 64.375% ± 10.19). Fifty percent or more of the young survive to fledging on sites in which ground cover is between 60% and 80%. Data comparisons will be conducted using descriptive statistics. Conclusions will be made to determine why some of the nest boxes are occupied as opposed to others based on the results of the habitat analysis.

**Board 71 ONSET OF CENOZOIC VOLCANISM AND REGIONAL EXTENSION IN NORTHEAST**

**NEVADA. Michael T. Rigby, rigbymit@notes.udayton.edu, (Allen J. McGrew, allen.mcgrew@notes.udayton.edu), Dept of Geology, University of Dayton, 300 College Park, Dayton OH 45469-2364.**

From 60 to 35 Ma, the western U.S. Cordillera experienced a time-transgressive transition from large-scale crustal shortening to regional extension. Proposed mechanisms for this transition include evolution of plate boundary conditions, buoyancy forces due to Mesozoic crustal thickening and/or replacement of mantle lithosphere by hotter, more buoyant asthenosphere. Widespread volcanism across the Cordillera is broadly synchronous with the onset of extension and has been linked to asthenospheric buoyancy models, but few studies have specifically documented this linkage. Our hypothesis is that extension and volcanism co-evolved at Copper Basin in northeast Nevada (Elko County). Copper Basin is flanked on the west by the Copper Creek detachment fault and consists of >1.5 km of late Eocene to Oligocene strata grading conformably upward from the volcaniclastic Dead Horse Formation into the conglomeratic Meadow Fork Formation. The appearance of metamorphic and granitic boulders eroded from the footwall of the fault defines a younger age limit of 29.4 Ma for the onset of faulting based on dating of an ash horizon within the upper Meadow Fork Formation. Additional dating of tuffs near the base of the Meadow Fork Formation will tighten this bracket relative to a 37.4 Ma age from the uppermost Dead Horse Formation. To develop a detailed history of footwall denudation, 1- 5 kg samples of conglomerate and ash fall tuff were collected throughout the sequence for clast counts and radiometric dating. Also, 50 granitoid cobbles were collected from four different stratigraphic horizons within the Meadow Fork Formation for U-Th/He dating. Analysis of these cobbles will be used to constrain the lower temperature cooling histories and thus the movement through the crust of the eroded footwall rocks.

**Board 73 A COMPARISON OF MANURE AND INORGANIC NITROGEN FERTILIZER AND THE RATE OF CORN PRODUCTION. Alan P. Sundermeier, sundermeier.5@osu.edu, Ohio State University Extension, 440 East Poe Rd, Bowling Green OH 43402.**

Is substitution of manure in corn production systems a viable replacement for inorganic nitrogen fertilizer? The objective of this study is to evaluate various application rates of inorganic nitrogen on fields treated with manure with respect to corn production. After this evaluation, then the application of inorganic nitrogen fertilizer may be reduced without a reduction in corn production. Field test plots were established in 2003, 2004, and 2005 in Wood County, Ohio. Each plot received an application of 7,000 gallons per acre of liquid dairy manure each year. Randomized, replicated field plots then had inorganic nitrogen fertilizer applied at the rate of zero, 50 and 100 pounds per acre. Three years of multiple site sampling collected data on the following indicators: soil nitrate, soil ammonium, corn leaf tissue nitrogen, corn stalk nitrate, and corn grain yield. The data collected indicate that there is no statistical difference (F value .05) in corn production between the three application rates of inorganic nitrogen fertilizer. Three year corn production averages in bushels per acre were 178.7 for zero rate, 182.2 for 50 pound rate, and 183.8 for 100 pound rate. These differences are not statistically significant. Results indicate that 7,000 gallons per acre of liquid dairy manure was able to support maximum corn production without the need for additional inorganic nitrogen fertilizer.

**Board 75 DEVELOPMENT OF A HYPERLINKED DATABASE FOR THE PROTECTION AND MANAGEMENT OF NORTHEASTERN KENTUCKY KARST RESOURCES. Stacey R. Wharton s06.swharton@wittenberg.edu and Horton H. Hobbs III hhobbs@wittenberg.edu, Dept of Biology, Wittenberg University, Springfield OH 45501-0720.**

Karst features, including caves, springs, sinkholes, vertical shafts, and natural bridges, of Carter County in northeastern Kentucky are numerous and varied. Data on over 150 karst attributes have been gathered since 1980, and 41 caves have been surveyed for a total of 18.1 km of passages. Many of these support a diverse flora and fauna, including the Federally endangered Indiana bat, *Myotis sodalis* Miller and Allen. In order to protect and manage these resources, a database of Carter County karst features was developed using Microsoft® Excel that allows for hyperlinkage to various data sets (e.g., locations, maps, descriptions, flora and fauna lists, photographs, survey data, references). Most of the data points are from within the boundaries of Carter Caves State Resort Park, although numerous data are from other parts of the county. The database allows the State Park and researchers within the park to access pertinent information about each karst element, allowing for better management and protection of these unique features. This is particularly crucial since many of the caves within the county serve as hibernacula for *M. sodalis*, including Bat Cave, which is designated a Critical Habitat for the bat. Rare plant species, such as the Mountain Maple (*Acer spicatum* Lamarck) and the Canadian Yew (*Taxus canadensis* Marshall), occur in this karst region and use of the database will aid in conserving these and other hypogean and epigean species.

**Board 77 AN INTEGRATED BIOSTRATIGRAPHIC APPROACH TO REFINING THE LOWER PALEOZOIC TIME SCALE OF CENTRAL IDAHO. Gary J. Motz[1], motzgarj@notes.udayton.edu, (Daniel Goldman[1], dan.goldman@notes.udayton.edu), Steve A. Leslie[2], saleslie@ualr.edu. [1]University of Dayton, Dept of Geology, 300 College Park, Dayton OH 45469-2364, [2]University of Arkansas, Little Rock AR.**

The geologic time scale is perhaps the most fundamental tool for studying Earth's dynamic systems. Modern Earth science studies increasingly rely on precise, time-calibrated data. Fossils have special status as the most important source of relative geologic time information. The primary objective of this research is to refine time scale for the Ordovician Period (489-443 mya). We plan to construct an integrated biostratigraphic model, for this period, using graptolites and conodonts. Specimens of these two groups usually occur in different types of rocks, causing correlation difficulties. The Trail Creek region of central Idaho has one of the most complete successions of Ordovician graptolite-rich rocks in the world, but no conodonts have been reported from this region. Samples were collected for processing from four sections: Trail Creek Summit, Little Fall Creek, Trail Creek Road, and Trail Creek. The Summit section is the longest stratigraphically, spanning the Lower Ordovician to Lower Silurian Periods, but it has a large stratigraphic gap in its lower portion. Additional graptolites collected from Little Fall Creek represent the time interval missing from the Summit section. Our faunas span the *Cardiograptus morsus* to *Nemagraptus gracilis* graptolite biozones. We also document the first conodonts known from the Trail Creek region in the Summit and Road sections. The Summit fauna belongs to the *Pygodus anserinus* conodont biozone and the Road fauna are currently under taxonomic review. By integrating the two fossil biozones, we will be able to correlate rocks from disparate biofacies, thereby refining the Ordovician time scale.

**Board 79 NEW MAP OF THE SURFICIAL GEOLOGY OF THE LORAIN AND PUT-IN-BAY 30 X 60 MINUTE QUADRANGLES, OHIO. Edward M. Swinford, mac.swinford@dnr.state.oh.us, Richard R. Pavey, Glenn E. Larsen, and Kim E. Vorbau; Ohio Dept of Natural Resources, Division of Geological Survey, 2045 Morse Road, Bldg. C1, Columbus OH 43229.**

As part of a statewide surficial geology mapping effort, a map depicting the surficial geology of the Lorain and Put-in-Bay 30 x 60 minute (1:100,000-scale) quadrangles has been produced by the Ohio Department of Natural Resources, Division of Geological Survey. Data sources include field mapping, county soil surveys, Ohio Department of Transportation and Ohio EPA boring logs, engineering logs, water-well logs, theses, and published and unpublished geologic and hydrogeologic reports. Surficial deposits were mapped at 1:24,000 scale for 36 7.5-minute quadrangles, compiled digitally using GIS technology, and converted into a full-color, print-on-demand, 1:100,000-scale, surficial-geology map which includes all or portions of Erie, Huron, Lorain, Lucas, Sandusky, and Seneca Counties in north-central Ohio. Map polygons were attributed using a stack-unit designator that indicates the thickness and stratigraphic sequence of major material units (e.g., till, gravel, sand, silt, and clay), from land surface down to and including the uppermost bedrock unit. Several regional material trends are apparent on the map, including large areas of lacustrine clay and silt landward of Lake Erie, the prominence of shallow bedrock paralleling the Lake Erie shoreline, a deltaic sequence deposited during higher levels of water of ancestral Lake Erie, locally widespread and thick organic and marl deposits, and the expanse of Wisconsinan-age till mantling most of the area in the quadrangles. The map text explains how to read the map, provides lithologic descriptions of mapped glacial and bedrock units, and offers other explanatory information. A GIS Geodatabase contains spatial information on each polygon and data attributes of the stack units that can be queried on the basis of material types and thickness to quickly create derivative maps.

**Board 81 DEMOGRAPHIC CORRELATES BETWEEN UPLAND AND WETLAND USAGE IN *AMBYSTOMA MACULATUM*. Christian D. Wright, wright_c@denison.edu, (Rebecca N. Homan, homanr@denison.edu), Denison University, Slayter Hall 1064, Granville OH 43023.**

Amphibian populations have been declining worldwide for decades and because of their importance as environmental indicators, and recently there has been an increase in the number of studies performed by conservation biologists studying these organisms. A 5 year study was initiated on a population of *Ambystoma maculatum* (spotted salamander) in an undisturbed environment located in the Denison University Biological Reserve in Granville, Ohio. The long term study is intended to examine the effects of habitat fragmentation on local amphibian populations. Specifically the goal of this study is to examine correlations between age structure and habitat quality in this local population. The data gathered will be used as a control to compare populations of *A. maculatum* in undisturbed habitats to those suffering from habitat fragmentation. Our hypothesis is that older individuals will inhabit habitats with a higher quality and that these relationships will be reflected in both wetland and upland habitats. Using a drift-fence immediately surrounding a semi-permanent pond that dries our between July and September, we monitored the number, sex, reproductive success, and orientation of this population daily. Upland habitat included any habitat surrounding the pond 100 meters away from the edge of the drift-fence which was positioned immediately around the pond. Habitat quality was ranked based on known information about habitat preferences in other populations of *A. maculatum* examined by researchers around the country. Approximately 30 percent of the population was tagged with a Passive Integrated Transponder and had a toe clipped to age the collected individuals. The population was aged using a long-bone growth ring analysis, specifically counting the number of lines of arrested growth from the toe sections. Previous experiments have shown that there are preferences in the selection of upland and wetland habitat for different age classes of *A. maculatum*. Statistical relationships have not been assessed due to continuing research.

**Board 83 THE DIETS OF EASTERN COYOTES (*Canis latrans*) AT THE WILDS, A RECLAIMED SURFACE MINE IN SOUTHEASTERN OHIO. Leeanna L. Pennington, leeannap@muskingum.edu, (Danny Ingold, ingold@muskingum.edu), Muskingum College, Biology Dept, New Concord OH 43762.**

The objective of this research is to determine if there are differences in coyote diet during different times of the year on a reclaimed surface mine, by examining scat samples collected from January 2005 through November 2005. We hypothesize that coyote scat during the winter months (December-February) will include less plant material and more animal material than during the rest of the year. The Wilds is a 3,700 hectare wildlife preserve located at the intersection of Guernsey, Muskingum and Noble counties, consisting mostly of grasslands, but also scattered tracks of *Lespedeza sp.* (woody legume), as well as islands of mixed hardwood-coniferous forest. Specifically this study will attempt to determine if there are detectable differences in coyote diet during the different seasons (winter = Dec-Feb, spring = Mar-May, summer = June-Aug, fall = Sept-Nov) using a series of one-way analysis-of-variance tests (content of scat = dependent variable; season = independent variable). Coyote scat will be collected along roadways and trails on all portions of The Wilds during each season. Scat will be identified as that of a coyote, by its dimensions, mass and content (see Green & Finders, 1981, J. Wildl. Manage.). Samples will be stored in labeled zip-lock baggies in a freezer and later autoclaved and rinsed through a sieve before analyzing the contents. Prey items in the scat (e.g. bones, hair, insect parts, etc.) will be identified using keys and reference books. The remains of vegetation (fruits, seeds and grasses) will also be identified when possible. The results of this study will help to shed light on the diets of coyotes on a reclaimed surface mine and whether those diets vary across seasons.

**Board 85 DESCRIPTION OF THE FIRST MITE DEFENSE SECRETION BY A NOVEL FORM OF REFLEX BLEEDING IN A TERRESTRIAL RED MITE. Jacob T. Ark, s08.jark@wittenberg.edu, Eric J. Rellinger, s07.erellinger@wittenberg.edu, Joshua B. Benoit, s05.jbenoit@wittenberg.edu, Jay A. Yoder, jyoder@wittenberg.edu, Wittenberg University, Dept of Biology, Springfield OH 45501.**

*Balaustium* mites are known for their quickness, bright red color, and population bursts in landscaping and on the walls of buildings. The key taxonomic feature of these mites is a pair of tubercles (urnulae) located on the dorsal idiosoma behind the eyes. Prior to this investigation, the function of these structures was unknown. Contribution of functional information regarding the urnulae was the goal of this study. Histological and morphological examination of urnulae by positive staining and ammoniacal silver nitrate revealed innervated longitudinal muscle and glandular tissue consistent with the function of an exocrine gland. In fact, disturbances prompt urnulae to evert and secrete a viscous, red fluid spread by setae over the mite's body surface, suggesting the derived fluid may have semiochemical properties. Allomonal characteristics were evaluated by applying the secretion to mealworms (*Tenebrio molitor*) and monitoring rate of attack by predatory ants. Frequency of attacks decreased 70% for mealworms treated with the secretion (N=15 replicates of 3 mealworms each with 10 ants per Petri dish), confirming defensive characteristics of the exudate. True to semiochemical parsimony, urnulae-derived secretion also prompted excited dispersal of conspecific mites. Of interest, alarm and defense responses were also noted in the presence of hemolymph extract, indicating the secretion's active ingredients are also present in the blood. Fluid dispersal over the entire body surface (not directed at the site of disturbance), blood-borne allomones, and ability to disrupt predatory chemoreception are all characteristic features of the *Balaustium* mite defense mechanism that parallel reflex bleeding in aposematic beetles.

**Board 87 A RAPID DEHYDRATION FEATURE OF THE ENTOMOPATHOGENIC FUNGUS *METARHIZIUM ANISOPLIAE* USED AGAINST TICKS IN BIOLOGICAL CONTROL. Justin L. Tank, s09.jtank@wittenberg.edu, Jacob T. Ark, s08.jark@wittenberg.edu, Eric J. Rellinger, s07.erellinger@wittenberg.edu, Joshua B. Benoit, s05.jbenoit@wittenberg.edu, Jay A. Yoder, jyoder@wittenberg.edu, Dept of Biology, Wittenberg University, Springfield OH 45501.**

Ticks spend the vast majority of their life crawling on the ground, enhancing exposure to commonly encountered fungi such as *Scopulariopsis brevicaulis*, *Aspergillus niger*, *Cladosporium cladosporioides*, *Penicillium glabrum*, and entomopathogenic *Metarhizium anisopliae*. Fungal infections, along with relative humidity, are important regulators of tick populations in nature. To evaluate the interdependence of these two factors, water balance characteristics of nonfed female lone star ticks were determined following exposure to individual mycoflora associates (N=45 ticks/treatment). Treatment with *M. anisopliae* induced a two-fold increase in water loss rate, which prevents ticks from stabilizing water levels (water gain '" water loss) at their critical equilibrium activity (CEA) of $0.85a_v$-$0.93a_v$ ($a_v$; $a_v$=r.h./100). Thus, *M. anisopliae* induces death by desiccation and served as our benchmark for comparing treatments with soil molds abundant in nature. Water loss rates were not altered by treatment with *C. cladosporioides*, which is consistent with its classification as a harmless saprophyte. For *Scopulariopsis brevicaulis*-treated ticks, elevated water loss rates are reported, but no effect was apparent for treatment with *A. niger*, implying this facultative parasite either was unable to switch to parasitism or could not effectively use ticks as a substrate. Ticks treated with *P. glabrum* lost water similarly to *S. brevicaulis*, indicating this saprophyte is pathogenic to ticks. Thus, fungal fauna directly impacts habitat preference, as infections can alter moisture requirements of their tick host. In addition, water loss rates are useful in assessing the pathogenicity of fungi targeted for use in biological control against ticks.

**Board 89 TESTES PROTEIN CLONING AND CHARACTERIZATION IN THE LEPIDOPTERANS *HELIOTHIS VIRESCENS*, *HELIOTHIS PELTIGERA*, AND *HELIOTHIS SUBFLEXA* SPERMTAIL. Benjamin H. Thirlby, thirlbbh@notes.udayton.edu, (Mark G. Nielsen, Mark.Nielsen@notes.udayton.edu), University of Dayton, Dept of Biology, 300 College Park, Dayton OH 45409-2320.**

Research in *Drosophila* species revealed that a fundamental component of its spermtail axoneme, Beta2 tubulin, has not evolved in amino acid sequence in 60 million years. Yet, data from two species indicates Beta2 evolves rapidly in Lepidopterans, raising the question, why is the same protein evolving rapidly in one taxa and not at all in another? One important difference between the Dipteran and Lepidopteran testis is that Dipterans use a major alpha tubulin isoform in the spermtail axoneme, and Lepidopterans a testis-specific alpha isoform. It is proposed that use of a testis-specific alpha isoform frees the Lepidopteran testis-specific beta isoform to evolve. To test this hypothesis, Beta2 is being cloned and testis proteins characterized in a third Lepidopteran species, *Heliothis subflexa*. RNA was isolated from dissected testes (N=4 preparations) and reverse transcribed into cDNA using Beta2-specific primers. A 1.3kb cDNA was amplified using polymerase chain reaction, and sequenced (Northwoods DNA, Becida, MN). A

GenBank nucleotide blast search (http://www.ncbi.nlm.nih.gov/BLAST) identified the cDNA as Beta2 tubulin (probability it is not Beta2 tubulin=$1/6*e^{-151}$). In our largest read of unambiguous sequence (519bp of 3′ sequence), 5 non-synonymous amino acid substitutions were identified compared to its closest relative in which Beta2 has been cloned (*H. virescens*). To determine if its rapid evolution extends to other testis proteins, in particular to alpha tubulin, testis protein preparations of *H. subflexa* (N=5) and *H. virescens* (N=5) are being analyzed using 2-dimensional gel electrophoresis, and compared to fruit fly testis proteins.

**Board 91 α AND β TUBULIN ISOFORM EXPRESSION IN *ANOPHELES GAMBIAE.* Michael D. Wigton, wigtonmd@notes.udayton.edu, (Mark G. Nielsen, Mark.Nielsen@notes.udayton.edu), Dept of Biology, University of Dayton, 300 College Park Drive, Dayton OH 45469-2320.**

How does protein function constrain protein evolution? The Drosophilid testis specific Beta2 has not evolved in 60 million years; in contrast, Lepidopteran Beta2 is evolving rapidly. One difference between these taxa which could affect evolution rates is the alpha tubulin isoform used in the testis; Drosophilids use the major alpha isoform, which also supports somatic function, and Lepidopterans use a testis-specific alpha isoform. If mosquitoes use a major alpha isoform to support the spermtail axoneme, we expect the testis-beta tubulin to evolve slowly in mosquitoes and relatives, but if it uses a testis-specific alpha, we expect the testis-specific beta tubulin to evolve rapidly. To address these hypotheses tubulin isoforms are being characterized in *Anopheles gambiae*. *Anopheles gambiae* were reared to adulthood and their tissues dissected for RNA and protein extraction. Gene specific DNA primers were designed to amplify *Anopheles* tubulins using sequences obtained from GenBank. The primers were tested on genomic DNA and products sequenced to verify their specificity (N=1 for each primer set). Primers were used in reverse transcription reactions using *A. gambiae* RNA isolated from testis and somatic tissues as templates. The EST data showed that both major alpha isoforms are expressed in testis and somatic tissues (N=1 for each tissue and isoform), a feature shared with *Drosophilids*. *Anopheles* Beta2 isoform was expressed in the testis, but was not testis-specific (N= 1 for each tissue). Two-dimensional protein gels are in progress to determine the effect of this change in isoform use on testis protein use and evolution.

**Board 93 INVESTIGATING WATER BALANCE CHARACTERISTICS OF THE TERRESTRIAL RED MITE (BALAUSTIUM SP.) TO ASSESS THEIR USE IN BIOLOGICAL CONTROL. Eric J. Rellinger, s07.erellinger@wittenberg.edu, Jacob T. Ark, s08.jark@wittenberg.edu, Joshua B. Benoit, s05.jbenoit@wittenberg.edu, Jay A. Yoder, jyoder@wittenberg.edu, Dept of Biology, Wittenberg University, Springfield OH 45501.**

A new species of red *Balaustium* mite rapidly crawls over landscaping and concrete edifices throughout central Ohio. Adults of the mite are conspicuous in late Spring, when populations number in the thousands but slowly decline over the subsequent month. Notably, *Balaustium* sp. possess chelicerae that are modified into a sword-like stylet that is differentially adapted for the predation of soft-bodied arthropods, such as scale insects and spider mites, which suggests that this mite may be useful in biological control. To provide insight into fundamental questions related to their survival, distribution, and possible range of application, we established the water balance profile for female adult *Balaustium* sp. (unidentified) (total N=300 mites). Notably, this mite features a 71% body water content, a 39% dehydration tolerance, and a modest water loss rate of 2%/h, prompting us to classify this mite as xerophilic. Unusual to these mites is their inability to absorb ambient water vapor at vapor activities ($a_v$=%RH/100) close to saturation and uptake water after first day passive gains. Absence of an active uptake mechanism was confirmed by scanning electron microscopy (N=20 mites), as no salt accumulation was observed around the base of the gnathosoma (SEM). *Balaustium* mites imbibe free water only when severely dehydrated, indicating that the primary water source for this mite is dietary. The relatively brief duration of the adult stasis and aggressive predatory life style make this mite ideal as a potential biological control agent.

**Board 95 THE CHARACTERIZATION OF PROTEIN EXPRESSION PATTERNS AMONG SIX DIPTERAN SPECIES. Lisa M. Griffith, griffilm@notes.udayton.edu, Mark G. Nielsen, Mark.Nielsen@notes.udayton.edu, Mike Wigton, wigtonmd@notes.udayton.edu, University of Dayton, 2916 San Rae Dr. Apt. 7, Kettering OH 45419.**

A fundamental component of Drosphilid spermtail axonemes, Beta2 tubulin, has not evolved at a single amino acid site in 60 million years. This protein comprises 35% of the mass of the spermtail. Previous research has found that small changes to Beta2 structure results in a complete loss of function and immotile sperm, putatively due to loss of proper interactions with other proteins in the axoneme. Therefore, it is hypothesized that Beta2 identity might control the evolution of other proteins within the axoneme, forcing them into a configuration amenable to Beta2 function. The objective of this research was to discover if Beta2 tubulin forces a particular molecular morphology onto the spermtail axoneme by using 2-dimensional gel electrophoresis to compare spermtail proteomes between *Drosophila melanogaster*, *D. virilis*, and *D. hydei*, which use the conserved Beta2 protein, and fly species using Beta2 proteins different from Drosophilid Beta2, *Musca domestica*, *Megaselia abdita*, and *Anopheles gambiae*. The 2D gel profiles (N=2 for each species) fell into two distinct groups, with Drosophilids and non-Drosophilids each displaying unique profiles. The Drosophilid profile was characterized by a diamond-shaped migration pattern, composed of eight proteins, reflecting proteins of both high and low molecular weight, and acidic and basic pH. However, the non-Drosophilids displayed approximately twenty fewer proteins overall. Their profiles formed a three-banded migration pattern reflecting high, mid, and low molecular weights near neutral pH. The results of this experiment reveal that the use of the conserved Beta2 tubulin does correlate with spermtail molecular phenotype, supporting previous research that identified a stringent structure/function relationship between Beta2 tubulin and the spermtail axoneme.

**Board 97 THE IMPACT OF TWO COMMON HERBICIDES ON GROWTH, DEVELOPMENT, AND SURVIVAL OF EASTERN GRAY TREEFROG TADPOLES (*HYLA VERSICOLOR*) Erica A. Kovacik, EKovacik@wooster.edu, Richard M. Lehtinen, RLehtinen@wooster.edu, 931 College Mall, The College of Wooster, Wooster OH 44691.**

In the last twenty years, amphibian declines have become a worldwide concern and appear to be occurring both in areas that are disturbed by humans as well as those that are considered to be relatively unimpacted. One hypothesis for the decline is lethal or sublethal effects from herbicides. In particular, two commonly used herbicides, atrazine and Roundup®, have been linked to reducing amphibian populations. To test this hypothesis, we conducted an experiment on Eastern gray treefrog tadpoles (*Hyla versicolor*) with a control and four treatments (atrazine at 5 ppb and 15 ppb and Roundup® at 0.3 ppm and 3 ppm). The experiment was conducted in 568 liter cattle tanks and each treatment was replicated five times with 19 tadpoles per replicate. Tadpole mortality and growth rates, the number of metamorphs, mass at metamorphosis and time to metamorphosis were analyzed to determine what effects the herbicides had on tadpole development. Roundup® treatments averaged 5.1 deaths in the first 10 days while atrazine treatments averaged 2.6 deaths and the control averaged 2.8 deaths in the same time period. Furthermore, the higher concentration of Roundup® showed higher mortality, with an average of 5.4 deaths as opposed to 4.8 in the low concentration of Roundup®. However, a multivariate analysis of variance found no statistically significant differences among any of the treatments ($p = 0.777$). This indicates that the herbicide treatments did not have any additional effects on the tadpoles beyond what occurred in a control where no herbicides were present.

**Board 99 ANALYSIS OF HYDROCARBON BIOREMEDIATION BY *SERRATIA MARCESCENS* IN CONTAMINATED SOIL. Deirdre M. Waddell, deedee.waddell@otterbein.edu, John Tansey, jtansey@otterbein.edu, (Amy Jessen-Marshall, ajessen-marshall@otterbein.edu), Otterbein College, SMC Box# 14053, One Otterbein College Westerville OH 43081.**

Hydrocarbon contamination of soil and water is of environmental concern and considerable research has been undertaken to identify microbes capable of metabolizing hydrocarbons to be used for bioremediation of contamination sites. Our goal was to identify soil microbes capable of hydrocarbon bioremediation and characterize the enzymatic pathways involved. Soil was collected from various soil parking lots exposed to gasoline and oil contamination located on the Otterbein campus, Westerville, OH. The soil was serially diluted and each dilution was plated on eight different hydrocarbon and minimal salt plates to culture the microbes present in the sample. The eight hydrocarbons consisted of used motor oil, clean motor oil, gasoline, hexanes, heptane, xylene, toluene, and cyclohexane. Plates were left in aerobic conditions at room temperature. After four days, there was substantial growth on the used motor oil, toluene, heptane, cyclohexane and hexane plates. *Serratia marcescens*, based on colony color and phenotype, was the

most common microbe growing on each of the plates. Surrounding each colony of *S. marcescens* was a clear zone, suggesting its ability to degrade the hydrocarbon on the plates, and was capable of bioremediation. Liquid gas chromatography was employed on toluene, heptane, hexanes, as well as hexanoic acid with the intention to assay the metabolic byproducts of *S. marcescens*. Characterization of the enzymes involved in the metabolism of these hydrocarbons is ongoing.

**Board 103 MICROBIAL DIVERSITY IN METAL CONTAMINATED SOILS OF KILGORE FARM USING GENOME SEQUENCING AND MICROBIOLOGICAL TECHNIQUES. R. Alexander Mack, alexander.mack@otterbein.edu, Matthew Fosnaugh, matthew.fosnaugh@otterbein.edu, (Amy E. Jessen-Marshall, Ajessen-marshall@otterbein.edu, Simon Lawrance, Slawrance@otterbein.edu, Jeffrey Lehman, Jlehman@otterbein.edu), Otterbein College, 1 Otterbein College, Westerville OH 43081.**

The Kilgore Farm, Delaware Co., OH, was home to ammunition manufacturing facilities during World War II. The destruction and burial of wastes took place on the property in a marked 'burn pit'. Our interest in the site is to determine the microbial diversity of the burn pit and to screen for bacteria tolerant for the metal contaminants present in the soil. Soil samples were taken from three sites within the burn pit and two sites out of the pit with the same soil type. From each site, samples were taken at a depth of 12", 24" and 40". Soils were digested with acid for ICP-MS spectrophotometric analysis to determine the metal composition in the samples. Genomic DNA was isolated from the samples using a gDNA isolation kit from Epicentre®. Bacterial universal primers were used with *Escherichia coli* DNA and the correct PCR conditions for amplification of the bacterial DNA from soil were determined. Metagenomes of DNA present will be obtained via a genome-sequencing of the 16srRNA subunit. Databases of bacterial sequences will then be analyzed in order to determine the bacterial genera present in the soil. In addition in-situ bacteria capable of metabolizing heavy metals are being identified on plates with various concentrations of barium, arsenic and copper. Classification and analysis of these bioremediators will be compared to the full diversity analysis by sequencing. Studying the transport and chemical pathways of the identified bacteria will aid in future research of bioremediation of the site.

**Board 104 ANALYSIS OF SEDIMENT CORES FROM CONTIENTAL SHELF AND CONTINENTAL SLOPE TO DETERMINE A PREFERENTIAL SITE FOR ORGANIC CARBON BURIAL IN THE OCEAN. Myung W Han, mhan@cscc.edu, Michael Hailu, mhailu@cscc.edu, Dept of Biological and Physical Sciences, Columbus State Community College, Columbus OH 43216.**

Biogeochemical cycle of carbon in the ocean, encompassing its production, decomposition and preservation, has been perturbed by the enhanced input of land-born nutrients and pollutants. The subsequent increase in carbon production in the form of particulate organic matter in coastal oceans has been known to serve as a "sink" of atmospheric $CO_2$ through the burial of particulate organic carbon in sediments. Two contending sites have been proposed for burial of organic carbon: continental shelf and continental slope. From each of the areas off Gampo, East (Japan) Sea a gravity core was retrieved and analyzed to determine if there is any physiographic preference for sedimentary organic carbon preservation. Concentrations of interstitial nutrients and total $CO_2$ were all distinctly higher with greater gradients in the shelf core (698 μM for ammonia, 25 μM for phosphate, 3.9 mM for total $CO_2$, all at the 43 cm subsurface) than the slope core (542 μM for ammonia, 12 μM for phosphate, 2.9 mM for total $CO_2$ all at the same depth). More rapid decrease in the interstitial sulfate concentration with depth in the shelf core (0.2 mM/cm) than in the slope core (0.07 mM/cm) indicates greater sulfate reduction at the shelf core. Sedimentary organic carbon and nitrogen contents were all lower and decreased more rapidly with depth at the shelf core. These interstitial and sedimentary results suggest that the particular organic carbon undergoes more active decomposition at the shelf core, supporting a preferential burial of organic carbon in the continental slope.

**Board 105 MODELING THE COST OF EVOLUTIONARY INTERMEDIATES USING GRAPH THEORY. Jeremy Joseph Lynch, lynchjej@notes.udayton.edu, Mary Loneta Hickey, hickeymz@notes.udayton.edu, (Mark G. Nielsen, mark.nielsen@notes.udayton.edu, Atif Abueida, atif.abueida@notes.udayton.edu), University of Dayton, 232 Stonemill Road, Dayton OH 45409.**

The problem of intermediates is fundamental to evolutionary biology - there may be adaptive forms that never evolve because the pathway to their evolution entails non-adaptive intermediates. To model this problem, we have constructed a 64 x 64 matrix whose vertices consist of the 64 nucleotide codons (the coding matrix). A "1" is entered in the matrix when a transition between two codons can occur in a single mutational step, and a "0" when >1 steps are needed, an intermediate step is necessary. Raising the matrix to the power *n* provides the number of paths of *n* steps between each codon pair. The cost of intermediates is given by the ratio λ, of single step to intermediate step transitions where $\lambda_{n(coding)} = \Sigma[a_{ij}]^n/\Sigma[a_{ij}]^{n+1}$. We then construct a second matrix, the function matrix, with the same vertices as the coding matrix, but with entries consisting of the probability of a transition occurring between two codon states based in the functional implications of the amino acid transition, as obtained from the Dayoff PAM250 amino acid transition matrix: transitions between amino acids of different chemistries are much less likely than transitions between similar amino acids, $\lambda_{n(function)}$. These ratios reveal the cost of intermediates to optimal evolutionary solutions: small numbers indicate that many of the best solutions to adaptive problems are not possible, and nature is a compromise, not the best of all worlds but the best possible world.

**Board 107 A NOVEL TWO-STAGE VALIDATION PROCESS USING FIELD TESTING TO IDENTIFY CARDIOVASCULAR DISEASE RISK IN ADOLESCENTS. Anne R Crecelius, crecelar@notes.udayton.edu, Reba A Sedlacek, sedlacra@notes.udayton.edu, David A Berning, berninda@notes.udayton.edu, (C. Jayne Brahler, brahler@udayton.edu), Dept Health and Sport Science, University of Dayton, 300 College Park, Dayton OH 45469.**

Body mass index [BMI; weight (kg) / height$^2$ (m$^2$)] and percent body fat (% BF; assessed using the OMRON™ Fat Analyzer Model HBF-3ed) are estimates of body fatness that are easily measured in non-laboratory settings. Body fatness is an independent risk factor for cardiovascular disease (CVD). Physical fitness is also an independent predictor for CVD and can be determined in K-12 children in non-laboratory settings using tests that provide normative data for comparison. However, fitness testing is time- and resource-intensive. The aim of this study is to validate the use of % BF versus BMI in predicting fitness levels in high school students while controlling for the influence of gender and age. It is hypothesized that % BF, not BMI, will reliably predict fitness across all groups using prediction equations based on data from approximately 1200 Xenia City School District 9th-12th grade students from Spring 2005. Validity and reliability testing will be completed using similar data collected Fall 2005. The usefulness of % BF as an indicator of cardiovascular disease risk is tested on data from a separate age- and gender-matched sample of students for whom fitness, BMI, % BF and blood chemistry data are available (N = 60). The statistical techniques to be used are a one-way ANOVA to determine significant differences between groups and multivariate stepwise regression to determine predictive equations. The information gleaned from this study will be used to advise Xenia City School District if it would be useful to make % BF determinations as a means for profiling CVD risk.

**Board 109 CARDIOVASCULAR RISK PROFILE FOR HIGH-RISK ADOLESCENTS AT XENIA HIGH SCHOOL. Lydia Mychkovsky, mychkolc@notes.udayton.edu, Katelyn Bennett, bennetke@notes.udayton.edu, (C. Jayne Brahler, brahler@udayton.edu), Dept Health and Sport Science, University of Dayton, 300 College Park, Dayton OH 45469.**

Statistically, eighty percent of obese American children become obese American adults; and an adult with obesity, who also was obese as a child, is at the highest risk for developing cardiovascular and metabolic disorders. Physical activity has the potential to ameliorate obesity and many of the related negative health conditions. Unfortunately, most K-12 students are required to participate in only 30 minutes of physical activity per week; falling far short of the Surgeon General's recommendation of 20-60 minutes of physical activity on most, if not all, days of the week. Subjects were a convenience sample of 59 female Xenia High School Students (ages 15-18) enrolled in the walking class Fall 2005 at Xenia High School (Xenia, Ohio). Study subjects were identified as being at risk for developing cardiovascular disease based on age- and gender-adjusted body mass indices (BMI) equivalent to the adult cut off pints of BMI e" 25 for overweight and BMI e" 30 for obesity. The purpose of this descriptive study is to provide Xenia

with a more comprehensive cardiovascular disease (CVD) risk profile for this sample of at-risk students and to provide baseline data for predicting the effectiveness of a new "Walking" class on the CVD risk profile for participating Xenia High School students. Data will include blood lipoprotein fractions, blood glucose concentrations, blood pressures, % body fat, and completion times for a one-mile walk/run test. Descriptive statistics will be used to determine if the subjects are at risk for CVD according to criteria established by the American College of Sports Medicine. Correlation tests will be completed to determine if mile run times are associated with CVD risk factors.

**Board 111 THE EFFECTS OF AMERICAN INFLUENCE ON ITALIANS: CORRELATIONS BETWEEN DIET, CULTURE AND PUBLIC HEALTH. Sarah McGillem, mcgillse@notes.udayton.edu, Kate Mone, monkatm@notes.udayton.edu, Lindsay Badertscher, badertle@notes.udayton.edu, (Patricia Dolan, dolanp@notes.udayton.edu, C. Jayne Brahler, brahler@udayton.edu), Dept of Health and Sport Science, University of Dayton, 300 College Park, Dayton OH 45469-1210.**

Have Italians begun to progressively drift away from the Mediterranean diet of fresh fish, fruits, vegetables, pasta, and olive oil toward the American trend of convenient and fast food? Unfortunately, the linear relationships between body fatness, consuming food away from home within the last 24 hour period and chronic diseases are already cause for public health concern in America. Is the same trend unfolding in Italy? For the current study, a survey was developed in English that asked respondents about their attitudes toward food and selected cultural beliefs. The survey also included a nutrition profile for each participant to fill out detailing specific food items they eat each week and where and with whom the food is consumed. The survey was translated into Italian, and English and Italian versions were posted online. Respondents were asked to complete the survey once and forward the email to ten friends (N = 2000). Descriptive statistics and frequencies will be calculated for all variables, and ANOVA tests will be run to check for significant differences between average number of meals eaten at home or eaten out during the week, and average number of snacks consumed per day between different age, gender, marital status, education and Nationality groups. Univariate General Linear Profile Plots will be drawn in order to visually identify the effects of age, gender, marital status, level of education and Nationality on dietary trends, meals eaten out or at home, and snacking habits. This study strives to determine the degree to which the diets of persons living in Italy are becoming Americanized.

**Board 113 AN ULTRASTRUCTURAL STUDY OF SPERMIOGENESIS WITHIN THE TESTIS OF THE GROUND SKINK, *SCINCELLA LATERALE*. Erin M. Mills, s06.emills@wittenberg.edu, Kevin M. Gribbins, kgribbins@wittenberg.edu, Wittenberg University, PO Box 720, Springfield OH 45501-0720.**

While the events of spermiogenesis are commonly studied in mammals, the amount of research available for reptiles is lacking. Many studies have described the morphological characteristics of mature spermatozoa in reptiles but few detail the ultrastructural changes that occur during spermiogenesis. The purpose of this study was to gain a better understanding of the subcellular events of spermiogenesis within the temperate Ground Skink *(Scincella laterale*). Samples of testes from 20 specimens were prepared using standard techniques for transmission electron microscopy. During early spermiogenesis within the Ground Skink testis, vesicles from the Golgi merge to form the acrosome and proacrosomal granules near the apex of the nucleus. Dispersed nuclear chromatin is then condensed into thick longitudinal fibers. Nuclear elongation occurs in response to further compaction of chromatin and stretching by the machette, a layer of microtubule scaffolding surrounding the sperm nucleus. The midpiece consists of a pair of centrioles surrounded by a fibrous sheath and a concentric ring of mitochondria. The centrioles are anchored in a depression at the base of the sperm nucleus and sustain the axoneme that appears at the end of the midpiece. The axoneme extends through the central part of the flagellum and gives rise to the typical 9 + 2 pattern of microtubules associated with the sperm tail. These morphological data are similar to that of the Jamaican anole and other tropical and temperate lizard species and suggest that seasonality and germ cell development strategy have little impact on the highly conserved steps of spermiogenesis within Sauria.

**Board 115 EVIDENCE OF CONTINUOUS SPERMATOGENSIS WITHIN THE TESTIS OF THE JAMAICAN ANOLE, *ANOLIS LINEATOPUS.* Jeremy C. Toffle. s06.jtoffle@wittenberg.edu, Kevin M. Gribbins, kgribbins@wittenberg.edu, Wittenberg University, Dept of Biology, PO Box 720, Springfield OH 45501-0720.**

Male reproductive activity in reptiles is typically seasonal. Most temperate species are highly asynchronous and only produce sperm during the warmer months of the year. Similar information suggests that many tropical species in both low and high elevation habitats practice seasonal sperm development in response to different amounts of rainfall. A recent study on the equatorial lizard, *Sceloporus bicanthalis*, provides evidence for continuous spermatogenesis with no seasonality. Similar results have been found for species within the genus *Barisia* in Costa Rica. The purpose for this study is to investigate sperm development within the tropical anole, *Anolis lineatopus*, and compare its germ cell development and seasonality to that of other tropical reptiles. Anoles were collected monthly in Jamaica from October 2004 to October 2005 (N=48; 4 per month). Three mm pieces of testis were fixed with 0.2% glutaraldehyde, dehydrated with ethanol, embedded in Spurr's plastic, sectioned (2ìm) with an ultramicrotome, and stained with toluidine blue and basic fuchsin. Histological observations indicate that Jamaican anoles exhibit spermatogenesis and spermiogenesis throughout the year. Spermatogonia, spermatocytes, and spermatids at various stages of development were observed within the seminiferous epithelium of every month sampled. Mature spermatozoa were also found in the lumina of seminiferous tubules in every month anoles were collected. Continuous spermatogenesis suggests that males always have sperm present. The importance of these data in relation to female oogenesis is not known. Little reproductive and life history information exists for male and female Jamaican anoles.

**Board 117 AN ULTRASTRUCTURAL STUDY OF SPERMIONGENESIS WITHIN THE TESTIS OF THE JAMAICAN ANOLE, *ANOLIS IINEATOPUS.* Jessica J. Schultz S07.jschultz@wittenberg.edu, Kevin M. Gribbins kgribbins@wittenberg.edu, Wittenberg University, Dept of Biology, PO Box 720, Springfield OH 45501-0720.**

In the present study, the steps of spermiogenesis are described for the Jamaican anole. The data collected from this ultrastructural study will help clarify details found at the light microscope level, which provided the first description of a primitive germ cell development strategy within an amniotic testis. Standard transmission electron microscopic techniques were performed on testicular tissue collected from Jamaican anoles sampled during each month of 2004 (n=48; 4 samples/month). Two proacrosomal granules produced from a juxtapositioned Gogli complex develop into the mature acrosome during early spermiogenesis. Nuclear condensation of DNA during elongation follows the pattern described for other amniotes. The fine filamentous chromatin is gradually replaced with courser dense granules that seem to arise from smaller dispersed nucleosomes within the nucleoplasm. The basal nuclear surface forms a fossa where it joins the proximal centriole of the tail. This region of the spermatozoa represents the midpiece and houses many mitochonrdria, which form a concentric ring around the centrally located flagellum. The proximal centriole is arranged perpendicular to the elongating distal centriole, which makes up the longest part of the flagellum (<30mm). This study provides specific data on the subcellular changes occurring to spermatids as they progress through spermiogenesis that parallels changes observed in germ cells at the light microscopic level. These data are also similar to the findings of other reptilian and avian species and support previously reported phylogenetic relationships that imply the close kinship shared by reptiles and birds using morphological characters of both spermiogenesis and mature sperm.

**Board 119 THE EFFECT OF β-GLUCAN ON IMMUNE FUNCTION IN CATS. Savannah S. Spring, sspring@notes.udayton.edu, Robert J. Kearns, kearns@udayton.edu, University of Dayton, 107 Evanston Ave, Dayton OH 45409.**

β-glucan is a glucose polymer typically found in yeast, fungi, bacteria and mushrooms. Previous studies have demonstrated that the intravenous administration of β-glucan increased the bactericidal activity of macrophages and neutrophils commensurate with stimulating humoral and cellular immunity. A paucity of information is available regarding the efficacy of orally administered β-glucan. The focus of this study was to determine whether orally administered β-glucan (500 ppm) enhanced immune function in cats. Control (n=14) and test (n=14) cats were initially placed on a controlled basal diet prior to the initiation of the study. Blood and fecal samples were obtained at day 0, 30 and 60 days post dietary supplementation with β-glucan. Data were analyzed using a one-way ANOVA. Animals fed β-glucan exhibited no significant

difference in NK cell activity (expressed as % cytotoxicity) when compared with control animals (Day 0: control 12.7±1.3; test 9.8±1.7, p>0.05; Day 60: control 21.02±3.3, test 22.11±3.3, p>0.05). Similarly, there was no effect of β-glucan on fecal IgA (Day 0: control 38.9±8.4 µg/g, test 47.3±18.9 µg/g, p>0.05, Day 60: control 30.1±3.8 µg/g, test 42.8±11.0 µg/g, p>0.05); IgG(Day 0: control 0.34±0.1 µg/g, test 0.38±0.01 µg/g, p>0.05, Day 60: control 0.39±0.13 µg/g, test 0.33±0.14 µg/g, p>0.05) or cortisol levels (Day 0: control 2.98±0.5 µg/g, test 3.39±0.65 µg/g, p>0.05, Day 60: control 2.98±0.46 µg/g, test 3.34±0.45 µg/g, p>0.05). Results from this study indicate that the oral administration of β-glucan in cats had no significant effect on NK cell activity, immunoglobulin or cortisol levels when compared with cats maintained on a basal diet.

# Poster Session B
# 10:00 – 11:00 AM

### Board 02 MOLECULAR CHARACTERIZATION OF CHIRONOMID SPECIES AND THEIR USE AS BIO-INDICATORS.

**Monita Sharma, monita.sharma@wright.edu, Chad Ferguson, chad.ferguson@wright.edu, Dan E. Krane, dan.krane@wright.edu, 235A, Biological Sciences, 3640 Col Glenn Hwy, Wright State University, Dayton OH 45435.**

Members of the family Chironomidae represent one of the most widely distributed and abundant insects in freshwater. Of all major aquatic invertebrate groups, midges of the family Chironomidae display the greatest range of pollution tolerances, in terms of both levels and types of pollution. While chironomids are excellent biological indicators of aquatic ecosystem integrity over various temporal and spatial scales and environmental gradients, their identification to species level – where they are the most informative – is limited by subtle morphological differences between species. Molecular, DNA-based techniques such as the Polymerase Chain Reaction (PCR) and ribosomal DNA (rDNA) sequencing have the potential to overcome these problems and expand the utility of chironomids in bioassessment. The conserved flanking sequences of the Intergenic Spacer Regions (IRS) regions, specifically the 18S and 28S subunits, facilitate amplification of these regions through PCR. Analysis of IRS-1 and IRS-2 of chironomid rDNA provide sequence data that suggests high amounts of variation between species of this group while intraspecific variation is low, confirming that this method is useful for discriminating species of the Chironomidae. Using the above molecular markers and methods, we have obtained sequence data for the following species: *Thienemanniella xena*, *Hayesomyia senata*, and *Tribelos fuscicorne.* Finally, molecular characterization of the Chironomidae allows important phylogenetic analyses and may provide insights into patterns of pollution tolerance in evolutionary relationships.

### Board 04 A COMPARISON OF MAXIMUM LIKELIHOOD AND MAXIMUM PARSIMONY METHODS OF PHYLOGENETIC INFERENCE UNDER CONDITIONS OF SUBSTITUTION RATE HETEROGENEITY.

**Sudhindra R. Gadagkar, gadagkar@notes.udayton.edu, Dept of Biology, University of Dayton, 300 College Park Ave., Dayton OH 45469-2320.**

Phylogenetic reconstruction using molecular sequences is typically undertaken under the assumption of homotachy (similar substitution rates across all the lineages for a given site in an alignment). However, it is being increasingly demonstrated that this assumption may not always hold in empirical sequence alignments, thus resulting in "heterotachy" among the sequences. Sequence alignments are likely to exhibit heterotachy with varying degrees of severity because the intensity of purifying selection and adaptive forces at a given amino acid or DNA sequence position is unlikely to be the same in different species. Several recent studies have examined various effects of heterotachy in sequence alignments. One such study investigated the influence of heterotachy on the performance of different phylogenetic methods using computer simulation, and reported that the Maximum Parsimony (MP) method generally outperformed the Maximum Likelihood (ML) method under these conditions. However, their findings are contradicted when these two methods are compared under the entire range of heterotachous sites. For example, it is seen that MP has a lower $BL_{50}$ (the minimum internal branch length at which 50% of the simulation replicates accurately reconstruct the phylogeny) than ML only when the proportion of heterotachous sites is in the range of 32% - 68%; ML is distinctly superior everywhere else. Again, when the entire range of possible heterotachous sites is considered, the proportion of trees inferred correctly by ML is 50% higher than that inferred correctly by MP. Therefore, in general, ML is superior to MP even under conditions of heterotachy in an alignment.

### Board 06 GINGIVITIS AND INTEGRIN-BETA-2: A SINGLE NUCLEOTIDE POLYMORPHISM ASSOCIATION STUDY.

**Kacy D. Walton, KacyWalton16@gmail.com, Benjamin K. Metz, BenMetz@hotmail.com, (Simon K. Lawrance, slawrance@otterbein.edu), Dept of Life & Earth Sciences, Otterbein College, Westerville OH 43081.**

Current research supports the hypothesis that gingivitis is caused not only by a lack of dental hygiene but also by genetic factors. The goal of this research is to test the hypothesis by assessing the relationship between single nucleotide polymorphisms (SNPs) in the integrin beta-2 gene and gingivitis. Previous research findings about integrin beta-2 and gingivitis in adult subjects have led us to hypothesize that the polymorphisms in the integrin beta-2 gene are significant genetic determinants in gingivitis. The recently published "HapMap" of single nucleotide polymorphisms (SNPs), including those in the integrin beta-2 gene, affords the opportunity for a case-control study designed to test the relationship between integrin beta-2 SNPs and gingivitis. A study population will be recruited from students at Otterbein College, Westerville, Ohio. Severity of gingivitis will be assessed for each subject using a standardized scoring system. DNA will be obtained from each subject using collection swabs and extraction solution from the Epicentre Buccal Amp kit. Polymerase chain reaction (PCR) reactions will be used to amplify the integrin beta-2 gene. PCR products will then be analyzed by single base extension to identify integrin beta-2 SNPs using the Applied Biosystems SNaP kit. The results of both types of subjects, positive or negative for gingivitis will then be compared to determine whether there is a link between the SNPs and gingivitis in the candidate gene integrin beta-2. It is anticipated that the results of this study will make a valuable contribution to our understanding of the role of genetics in periodontal disease.

### Board 08 DIFFERENTIAL GENE EXPRESSION IN PROSTATE TUMOR CELL POPULATIONS.

**Katie E. Brown (kbrown10@kent.edu), Jennifer L. Reese (jreese5@kent.edu), Kylie M. Graham, Gail C.Fraizer (gfraizer@kent.edu), Dept of Biological Sciences, Kent State University, Kent OH.**

A better understanding of cell-cell communication between prostate epithelial and stromal cells is central to treating prostate cancer and may lead to novel therapeutic approaches. Microarray studies have provided an unbiased view of those transcripts differentially expressed in tumor cells compared to normal. However, these studies are difficult to interpret since both tumor and normal samples actually contain a mixture of cells (and therefore, the cellular source of the transcripts cannot be identified). This study analyzes differences in gene expression between cell types within the euplastic prostate. Our hypothesis is that potential pathways of cell-cell communication between tumor epithelial cells and adjacent stromal cells can be identified by differences in gene expression patterns. This is important because if stromal cell gene products alter the microenvironment of the adjacent tumor epithelial cells, they would affect growth of the prostate tumor in the patient. The gene expression patterns of tumor epithelial cells were compared to those of interstitial stromal cells. Approximately 1000 to 2000 epithelial and stromal cells were obtained by laser capture microscopy of frozen tumor tissue sections from three different patients with prostate cancer. Fourteen different RNA preparations were purified and their quality and quantity were assessed by Agilent Bioanalyzer. Nine different RNA samples were amplified and labeled for hybridization to Affymetrix U133V2 oligonucleotide arrays. The signal strength of seven scanned arrays was normalized and genes whose expression was 2-fold or greater in epithelial than in stromal cells (and vice versa) were identified. 50 genes were up-regulated 23-fold or greater in epithelial cells and 59 genes were up-regulated >23-fold in stromal cells. The genes expressed in the tumor epithelial cells included both prostate specific genes like PSA/ Kallikrein 3 (upregulated 119-fold) and epithelial marker genes like ketatin 18 (up 50-fold). Similarly stromal marker genes like vinculin (up-regulated 24- fold) and desmin (up 38-fold) were expressed in the cells collected from adjacent stromal tissue. Gene onotology analyses revealed that genes upregulated in stromal cells fell into eight functional categories. Within the cell proliferation category were growth factor genes up-regulated in stromal cells, including: basic fibroblast growth factor (FGFb) and Insulin –like growth factor 1 (IGF-1). Since their cognate receptor genes (FGFR-2 and IGFR-1) were up-regulated in epithelial cells, this suggested a potential mechanism of cell-cell communication. That is, if these transcripts were translated, then stromal cells could have provided

growth factors that stimulate epithelial cell receptors. Overall, these results demonstrate that genes differentially expressed in different tumor cell compartments include those important to growth regulation. These results are consistent with our hypothesis that stromal cell gene products may alter the microenvironment of the adjacent tumor epithelial cells and promote tumor growth. Supported by NIHR15CA113360, Ohio Board of Regents and KSU-University Research Council.

**Board 10 AUTOMATION OF THE RETRIEVAL AND ANALYSIS OF ORTHOLOGOUS GENE DATA FROM PUBLIC DATABASES. Philip E. Pfeiffer[1], pfeiffpe@notes.udayton.edu, (Sudhindra R. Gadagkar[2], gadagkar@notes.udayton.edu), [1]Dept of Computer Science, University of Dayton, 300 College Park Ave., Dayton OH 45469-2160, [2]Dept of Biology, University of Dayton, 300 College Park Ave., Dayton OH 45469-2320.**

Can novel gene functions arise without novel genes? Evidence from mouse and human genomes, which have approximately the same number of genes – 30,000, appears to support this idea. If two orthologous genes diverge functionally, does the pattern of substitution differ between the two corresponding gene sequences? The Disparity Index ($I_D$) test can be used to determine if two orthologous sequences are evolving with the same substitution pattern, and functional divergence can be ascertained from the Gene Ontology compilations. If evolutionary (substitution) pattern divergence and functional divergence are found to be correlated, then the $I_D$ test can become a good predictor of functional divergence between pairs of orthologous genes. This test could then be used as an extremely easy and inexpensive means of comparing a gene whose function is unknown with an ortholog whose function has been already been determined. In order to ascertain such a correlation, information on the structure and function of many orthologous genes needs to be available. Fortunately, mouse and human form an ideal pair for this purpose, with ~15,000 genes identified as orthologous, and exon-intron information and reliable function assignment available for many of them in both species. Furthermore, all this information is available in the public domain. However, it is clear that given the number of genes, such tasks are best undertaken computationally. Accordingly, the goal of this project is to use the publicly available NCBI software Toolkit supplemented with in-house computer programs to automate the task of retrieving the sequence data and analyzing it.

**Board 12 TRACING THE EVOLUTIONARY ORIGINS OF GENES IMPLICATED IN ALZHEIMER'S DISEASE. Hanny Al-Samkari, alsamkht@notes.udayton.edu, (Sudhindra R. Gadagkar, gadagkar@notes.udayton.edu), Dept of Biology, University of Dayton, Dayton OH 45469-2320.**

Alzheimer's disease (AD), a degenerative, irreversible neurological human disease, is the leading cause of dementia in the elderly, and has no known cure. Recent studies have associated several genes with this and other related neurological disorders. 5-Hydroxytryptamine Transporter (*5-HTT*), sometimes called the "Depression Gene" and Apolipoprotein E4 (*ApoE4*) are two of several genes strongly implicated in AD. This project has been undertaken in order to determine the evolutionary history of *5-HTT* (and possibly the other implicated genes including *ApoE4*) across many species, and depending on data-availability, trace the origin of the disease-causing mutations in humans. This is possible by dissecting structural changes in these genes over evolutionary time in human and other lineages. Sequence data is being collected from public databases for this purpose. *5-HTT* is 37.8 kilo base pairs (kbp) long in humans, including 13 exons (protein-coding regions), introns, and regulatory regions. It also has multiple alleles (alternative forms) and each allele is associated with a radically altered phenotype. Comparative sequence analysis techniques will be used to provide insight into how *5-HTT* (and other implicated genes such as *ApoE4*) have been altered over time, including the origin of the alleles. While numerous studies have already been conducted on *5-HTT*, *ApoE4*, and other neurological disease genes, they have mostly been from a biochemical or clinical perspective. The approach here is evolutionary and it is hoped that the results of this study will provide an understanding of these genes and Alzheimer's disease from a unique perspective.

**Board 14 DIFFERENTIAL PROTEOMIC EXPRESSION IN AQUAPORIN 5 TRANSGENIC MICE. Alison A. Staton, statonaa@notes.udayton.edu, and (Carissa M. Krane), Carissa.Krane@notes.udayton.edu, Dept of Biology, University of Dayton, 300 College Park, Dayton OH 45469-2320.**

Maintenance of fluid homeostasis is a crucial part of sustaining normal physiology. Aquaporin 5 (AQP5) is a major water channel found in lacrimal and salivary glands and in epithelia of the cornea. In the lung, AQP5 is expressed in airway and alveolar epithelium. A mouse model lacking AQP5 has been shown to be hyperresponsive to cholinergically-stimulated bronchoconstriction, a hallmark of asthma. However, the exact mechanism behind this constriction remains largely unknown. Insight into how this happens could lead to improved characterization and treatment of asthma. It was hypothesized that because AQP5-null mice function normally under non-stressed conditions, the lung must compensate for AQP5 loss by varying the expression of other proteins. Therefore, proteomic studies were conducted in order to examine the global expressioni of proteins in the lung. Membrane protein samples from AQP5 wildtype (n=3) and knockout (n=3) mice were extracted and quantified. Sample integrity was confirmed using SDS-PAGE. Samples were then analyzed using 2-dimensional gel electrophoresis, separating proteins based on both isoelectric point and molecular weight. Proteins were stained with silver, imaged, and examined for differences in profiles comparing the proteins expressed in AQP5 deficient vs. wildtype mice. This analysis has revealed no proteins which exhibit altered expression profiles as a result of AQP5 deficiency in mouse lung.

**Board 16 IDENTIFICATION OF UNKNOWN TADPOLES USING ALLOZYME VARIATION. E. Rhiannon Crouse, crouse_e@denison.edu, (Jessica E. Rettig, rettig@denison.edu, Geoffrey R. Smith, smithg@denison.edu), Denison University, Dept of Biology, Granville OH 43023.**

Cellulose acetate electrophoresis is a technique commonly used to identify and separate allozymes, especially in the medical field. It has slowly been gaining popularity in the life sciences as a method of differentiating populations and species of organisms by variation in their allozymes. This research project uses cellulose acetate electrophoresis to differentiate between several species of tadpoles that are morphologically similar at early life stages: bullfrog (*Rana catesbeiana*), green frog (*Rana clamitans*), and American toad (*Bufo americanus*). Currently we have found four allozymes that resolve in bullfrog tissues (*R. catesbeiana*): isocitrate dehydrogenase (IDH), malate dehydrogenase (MDH), and lactate dehydrogenase (LDH). As we perfect the protocol for these allozymes, we will examine tissue from adults of the three species to look for diagnostic allozyme variation. Once we identify diagnostic allozymes, we will also assess allozyme activity across a developmental series of tadpoles, to determine when particular allozymes become active in the tissues. With this knowledge, our goal is to be able to determine a reliable method for identifying unknown tadpoles.

**Board 18 MIP FAMILY MEMBERS IN COPE'S GRAY TREE FROG *HYLA CHRYSOSCELIS* EXHIBIT TISSUE-SPECIFIC AND THERMAL-SENSITIVE GENE REGULATION. Sarah L. Zimmerman[1], zimmersl@notes.udayton.edu, David L. Goldstein[2], David.Goldstein@wright.edu, James Frisbie[2], frisbie.2@wright.edu, Andrew Diller[2], diller.7@wright.edu, and Carissa M. Krane[1], Carissa.Krane@notes.udayton.edu, [1]Dept of Biology, University of Dayton, 300 College Park, Dayton OH 45469-2320 and [2]Dept of Biological Sciences, Wright State University, Dayton OH 45435.**

Water selective aquaporins (AQPs) and glycerol permeable aquaglyceroporins (AQGLPs) belong to a family of membrane integral proteins (MIP) present in all organisms. Cope's gray treefrog *Hyla chrysoscelis* accumulates glycerol during cold acclimation in anticipation of possible freezing. Given the substantial movements of water and glycerol in cold and freezing frogs, we hypothesized that AQPs and GLPs are involved in amphibian osmoregulation. Therefore, we sought to identify members of the MIP family in order to examine their potential role in this process. First strand cDNA was synthesized from total RNA isolated from frog kidney, bladder, and liver. Degenerate nucleotide primers designed to conserved regions of previously cloned anuran AQPs were used to PCR amplify frog cDNA. Each experiment was replicated. Amplification products were cloned and sequenced. Using this method, we identified three novel members of the MIP family. HC-1 exhibits 98% amino acid identity with the water channel AQP1 and is ubiquitously expressed. HC-2 encodes a 280 amino acid protein and shares ~60% amino acid identity with various AQP2 orthologs. HC-2 expression is highly tissue-specific, found primarily in organs of osmoregulation and varies with thermal acclimation. HC-3 is most similar to anuran and mammalian AQP3 and subject to both tissue-specific and thermal selective regulation. In conclusion, three new members of the MIP family present in *H.*

*chrysoscelis*, two of which are subject to tissue-specific and thermal-responsive gene regulation were identified. These results strongly implicate the participation of the AQP/AQGLP molecules during thermal acclimation in Cope's gray tree frog.

**Board 20 THE ROLE OF *PITX2* IN ANTERIOR SEGMENT DYSGENESIS IN THE ROCKY MOUNTAIN HORSE. Sasha N. Hill, Sasha.Hill@otterbein.edu, Susan Ewart, ewart@cvm.msu.edu, (Simon K. Lawrance, slawrance@otterbein.edu), Dept of Equine Science, Otterbein College, Westerville OH 43081.**

The goal of this research is to isolate the gene(s) within the Rocky Mountain Horse (RMH) that contribute to the ophthalmologic condition known as anterior segment dysgenesis (ASD). Particular attention will be drawn to the site of the homeobox transcription factor PITX2. *PITX2* is a superb candidate gene within the equine genome due to the number of similarities ASD possesses with Reiger's syndrome, an autosomal dominant genetic disorder that shows iris and corneal changes when *PITX2* mutates. Therefore, we hypothesize that mutations in the RMH *PITX2* gene are associated with the abnormal ocular development of ASD. Approximately fifty Rocky Mountain Horses, *Equus caballus*, with and without ASD were identified from horse farms around Ohio for this study. Epithelial cheek cells were collected and extracted using the Epicentre Buccal Swab DNA Extraction Kit. Equine specific *PITX2* primers were developed by comparing the known human and mouse *PITX2* sequences. Conserved sequences were used to generate primers for *PITX2* exons. Polymerase chain reaction is now being used to amplify the exons. Once amplified, the Applied Biosynthesis Genetic Analyzer will be used to sequence *PITX2* exons and to detect any mutations that may be present. The pool and sequence method will be used to compare the gene sequences of RMHs with and without ASD. Mutations detected will be confirmed by repeat sampling and sequencing. Correlation of ASD with *PITX2* mutation will provide evidence that this gene plays a significant role in the ophthalmologic conditions that occur in the RMH and will provide insights into the etiology, diagnosis, prevention and therapy of ASD.

**Board 22 *IN-SILICO* PREDICTION OF FUNCTIONAL DIVERGENCE BETWEEN ORTHOLOGOUS GENES BASED ON COMPARISON OF THE SUBSTITUTION PATTERNS BETWEEN MOUSE AND HUMAN. Allison A. Piszkiewicz, piszkiaa@notes.udayton.edu, Sudhindra R. Gadagkar, gadagkar@notes.udayton.edu, Dept of Biology, University of Dayton, 300 College Park Ave., Dayton OH 45469-2320.**

The genesis of novel gene function is of considerable interest in biology. This study was undertaken to determine if *in-silico* methods could predict functional divergence between two orthologous genes based on evolutionary (substitution) pattern divergence. Substitution pattern divergence can be computationally determined by means of the Disparity Index ($I_D$) test, and functional divergence ascertained from the Gene Ontology (GO) website. Accordingly, the first 200 genes of the approximately 15,000 known orthologous genes between mouse and human were screened and 37 found suitable for analysis (e.g., either DNA or protein sequences available for both species). Of these, three genes for which function has been reliably assigned in both species showed homogeneous substitution patterns based on the $I_D$ test. On the other hand, the $I_D$ test indicated divergent substitution patterns for seven genes, but functional annotation is either not reliable or missing for these genes. Thus, although this is not conclusive evidence that the $I_D$ test has identified genes for which function has diverged between the two species, the results are encouraging because there is not a single case of a contradiction (e.g., significant $I_D$ result when there is strong evidence for the same function in both species). Whether this is a case of genuine lack of false positives will of course be ascertained with certainty only when more genes become available with stronger evidence for the assigned function. Therefore, this study indicates that extending these investigations to all available orthologous genes between mouse and human appears to be a worthwhile endeavor.

**Board 24 TEMPORAL AND WEATHER INFLUENCES ON HAUL-OUT BEHAVIOR OF RINGED SEALS, *PHOCA HISPIDA*, IN PRUDHOE BAY, ALASKA. Lynn Waterhouse[1], waterhlz@notes.udayton.edu, Patrick K. Williams[1], Kelly.Williams@notes.udayton.edu, Brendan P. Kelly[2], brendan.kelly@uas.alaska.edu, [1]University of Dayton, Dept of Biology, Dayton OH 45469-2320 and [2]University of Alaska Southeast, Juneau AK.**

In winter and early spring, ringed seals (*Phoca hispida*) rest on the ice surface in snow caves (subnivean lairs). In late spring, they emerge from the lairs and rest in the open. These two behaviors are termed "haul-out" behaviors. Ringed seals can be counted during aerial surveys only after emerging from their lairs and resting on the ice surface. Understanding the dynamics of seal haul-out behavior is necessary to understand their life cycle. In the springs of 1999 through 2003, 66 ringed seals were captured and tagged in Prudhoe Bay, Alaska. A VHF transmitter was attached to each seal. A log was kept of the seal's time out of the water and its location. Temporal and weather variables recorded hourly included air and snow temperature, wind speed, wind direction, percentage cloud cover, presence of fog, and relative humidity. It is hypothesized that factors such as percentage cloud cover, air temperature, and snow temperature would influence the probability of a seal resting on the ice surface. Neither univariate analysis nor multivariate analysis showed correlations between any of the above factors and haul-out behavior. The frequency of resting in lairs for less than one hour was disproportionately high among females (n=91 of a total 253 lair periods for females). In comparison, of the 276 male lair periods, only 39 spent less than an hour, with the majority (n=155) staying 5 to 15 hours. These data analyses show that temporal and weather factors alone do not determine haul-out behavior of ring seals.

**Board 26 TYPE II DIABETES RISK ANALYSIS FOR XENIA, OH ADOLESCENTS. Mary C. Hicks, hicksmac@notes.udayton.edu, Lauren M. Doll, dolllaum@notes.udayton.edu, (Janine Baer, baer@udayton.edu, Jayne C. Brahler, brahler@udayton.edu), University of Dayton, 300 College Park, Dayton OH 45469.**

Type II diabetes is the 5th leading cause of death in Ohio. In particular, Greene County, Ohio (including Xenia) reports 85-156 diabetes-related discharges per 10,000 residents per year. Only 15% of Xenia residents meet the recommendations of engaging in physical activity 30 minutes per day, 5 days per week, and almost half of Xenia adults are overweight (BMI > 25) or obese (BMI > 30). In order to combat one of the primary risk factors for type II diabetes (physical inactivity defined as less than 10,000 steps/day or less than 30 minutes of moderate exercise 5 days per week), Xenia High School implemented a for-credit "Walking" class that meets 5 days per week for 50 minute sessions. Students who are overweight or obese are invited to enroll. This descriptive study provides a type II diabetes risk analysis for the Xenia High School students (14-18 yr; n=60) enrolled in the Fall 2005 walking class. Diabetes risk indicators include: obesity (BMI: kg/m^2) > age and gender adjusted cut off points for children), elevated fasting blood glucose (> 110 mg/dL), poor dietary intakes (%fat intake > 30%, simple sugar intake > 50g, and a fiber intake < age+5g). Subject age and gender are included in multivariate analyses with risk factors to examine their potential covariate effects and subject self-efficacy (Rosenberg Self-Esteem questionnaire) is investigated as a novel independent risk factor. This study has been approved by the Committee for the Protection of Human subjects at the University of Dayton.

**Board 28 VALIDATION OF NUTRITIONAL STATUS BY DIETARY REPORT AND BLOOD LIPID PROFILE OF ADOLESCENTS. Jan Kajzer, kajzerja@notes.udayton.edu, (Jayne Brahler, brahler@udayton.edu, Janine Baer, baer@udayton.edu), University of Dayton, 300 College Park, Dayton OH 45419.**

The prevalence of adolescent obesity (BMI>30) in the U.S. has risen dramatically, affecting 25-30 % of children. The problem is rooted, in part, in lifestyle factors influenced by stressors including fast food, inadequate nutrition knowledge, and sedentary lifestyle. The goals of the present project include determining the reliability and validity of student reported dietary information and quantifying the risk of cardiovascular disease in adolescents as evidenced by relationship of dietary intake to fasting blood lipids. Approximately 50 adolescents aged 14-18, identified to be at risk for chronic disease based on lifestyle factors, will participate in self-reported dietary analysis and blood work data collection. Dietary analysis consists of student-completed 24-hr food records auto-analyzed by mypyramid.gov and validated by technician assisted Nutritionist IV Dietary analysis of the same. Blood work consists of 4 ml of fasting serum collected and analyzed for: total cholesterol, low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, very-low density lipoprotein cholesterol, triglycerides and glucose by standardized laboratory methods (CompuNet Labs). In addition to determining reliability and validity of student dietary records by mypyramid.gov to Nutritionist IV, the present study will provide data on the relationship of dietary intake and cardiovascular disease as evidenced by blood work in this adolescent population who

demonstrate lifestyle factors associated with the risk of obesity. The data provided will be useful in developing nutrition education interventions to address dietary practices associated with obesity and chronic disease.

**Board 32 CORRELATION BETWEEN CHRONIC ANXIETY AND THE VOLUME OF THE HYPOTHALAMUS IN A COMMUNITY BASED SAMPLE OF WOMEN. Suellen Yekisa (s06.syekisa@wittenberg.edu), Lindsey Veit (s05.lveit@wittenberg.edu), Cathy L. Pederson (cpederson@wittenberg.edu), Wittenberg University, Dept of Biology, Springfield OH 45501.**

The hypothalamus mediates life functions in the body such as blood pressure, respiration, motivational drives, and sleeping. The hypothalamus has been linked with anxiety due to the changes in heart rate, blood pressure, and eating and sleeping patterns during stress. Twenty right-handed women between the ages of 20 and 40 were placed into anxiety (anxiety scores>85) and control (anxiety scores<48) groups (n=10 per group) based on the Millon Clinical Multiaxial Inventory (MCMI-III). The anxiety group was hypothesized to have a larger hypothalamus due to increased activity during stress. Participants were given a demographic questionnaire, the Wonderlic Personnel Test, the MCMI-III and a magnetic resonance scan (MRI) of their brain. Researchers blind to group assignment traced the hypothalamus on the MRIs using 3D Brainstation. Each slice was traced twice, averaged, and the areas were summed to obtain the total volume of the hypothalamus. Groups were matched for average abuse, average neglect, body mass index, number of drinks per year, intelligence, pack years of cigarettes smoked, and marijuana usage ($p>.05$). Rates of depression could not be controlled, and there was a significant difference between the groups $F(1, 18)= 7.15$, $p<.05$. Anxiety was intentionally manipulated for a significant difference between groups and statistics were done covarying depression, $F(1, 17)=30.16$, $p<.001$. There was no significant difference, however, in the volume of the hypothalamus between groups when covarying depression, $F(1, 17)=.52$, $p=.48$. This study did not find the volume of the hypothalamus to be larger in the women with anxiety.

**Board 34 AUTOIMMUNE DISEASES AND CANCERS OF HUMAN KIDNEY EVALUATED FROM TISSUE BIOPSIES BY MEANS OF HIGH RESOLUTION LIGHT MICROSCOPY, IMMUNOMICROSCOPY, AND TRANSMISSION ELECTRON MICROSCOPY(TEM). Stacy L. Fennell, s07.sfennell@wittenberg.edu, David L. Mason, damson@wittenberg.edu, Wittenberg University, Box 1690, Springfield OH 45501.**

Various human kidney diseases presenting from tissue biopsies of 35 patients at Community Hospital in Springfield OH, and other hospitals in the Dayton Miami Valley OH, were evaluated by microscopy for accurate identification. Tissues from kidney biopsies of Poststreptococcal glomerulnephritis revealed by TEM accumulations of immune complexes in a "lumpy-bumpy" pattern between the podocytes and basement membrane of glomeruli. IgA nephropathy (Berger Disease) revealed by immunolight microscopy IgA deposition, and the immune deposits were seen in the mesangial and membrane regions by TEM. With lupus nephritis, dense immune deposits were seen along the basement membrane of glomeruli, and by immunomicroscopy IgG was detected. TEM revealed the immune deposits to be both subendothelial and subepithelial and in the mesangial regions. Cancers of the kidney included: oncocytoma, renal cell carcinoma (clear cell), squamous cell carcinoma, and transitional cell carcinoma. With oncocytoma munerous mitochondria were readily seen in cells by light and TEM. With Clear cell carcinoma (renal cell carcinoma) the cytoplasm was seen to be somewhat devoid of organelles. With squamous cell carcinoma the proliferating cells in a glomerulus stained red with antikeratin antibody. With transitional cell carcinoma in the calyx, malignant cells revealed and immunoidentification for CEA and B72.3 antigens. Thus, high resolution light microscopy, immunomicroscopy, and electron microscopy maybe very helpful in the proper identification of human kidney diseases.

**Board 36 DETERMINATION OF $\alpha3\beta1$ AND $\alpha6\beta4$ INTEGRIN MOLECULES ON TUMORIGENIC AND NON-TUMORIGENIC RAT ESOPHAGEAL CELL LINES. Brian F. Schmidt, bschmid@bgnet.bgsu.edu, Arup R. Chackraborty, arup@bgnet.bgsu.edu, Roudabeh J. Jamasbi, rjamasb@bgnet.bgsu.edu, Dept of Biological Sciences, 217 Life Science Building, Bowling Green State University, Bowling Green OH 43403.**

The progression of cells from normal to cancerous stage is associated with a variety of changes in cell growth and proliferation, including changes in integrin expression. The main objective of this investigation was to determine the expression of $\alpha3\beta1$ and $\alpha6\beta4$ integrin molecules on esophageal cancerous cell lines (RE-B2T and RE-C1T) and non-cancerous, but transformed cell lines (RE-79, RE-149, and RE-282). We hypothesized that the decrease in expression of these adhesive molecules may enhance the metastatic capability of these cancerous cell lines. Normal rat kidney, trachea, and fibroblast cells served as controls. Monoclonal antibodies 5A (anti-$\alpha3\beta1$ integrin), and a monoclonal antibody (anti-$\alpha6\beta4$) were used in this study. The expression of these molecules at the antigen level was determined by ELISA, immunohistochemistry, and at the mRNA level by RT-PCR. The results showed a 12-48% decrease in the expression of $\alpha3\beta1$ integrin on C1T and B2T cells, respectively. However, the expression of $\alpha6\beta4$ integrin was decreased by 10% on these cell lines, compared with non-tumorigenic transformed cell lines, at both the protein antigen and at the mRNA levels. We concluded that the reduction in expression of these integrin molecules may enhance tumor cell motility, and contribute to the metastatic spread of tumor cells *in vivo*.

**Board 38 THE EFFECTS OF THE NIGHTSHADE FAMILY ON PIG BRONCHIOLES. Bryan A. Knight, b-knight.1@onu.edu , (David Kinder, d-kinder@onu.edu), Ohio Northern University, 127 ½ South Main Street, Ada OH 45810.**

Native Americans used plants of the nightshade family to take advantage of presumed anticholinergic activity of the plants. Thus, extracts of the *Solanaceae* family should have the ability to block the constriction of pig bronchioles in the presence of cholinergic agonists, such as Acetylcholine (Ach). This experiment tested whether anticholinergic activity was present in nightshade plant extracts from *Lycium pallidum*, *Physalis hederifolia*, and *Solanum jamesii* species. Bronchiole segments were removed from ten pig lungs and placed in organ baths containing warm (37°C) Krebs solution. The rings were placed under 2g of tension, allowed to equilibrate for one hour, and then were challenged with Ach ($10^{-6}$M), followed by Epi ($10^{-6}$M) to assess initial contraction and relaxation respectively. The bronchioles were then incubated with 10ìl of one of the raw plant extracts (extracted in ethanol), vehicle (ethanol) or positive controls (scopolamine and atropine) prior to retesting with Ach and Epi. Scopolamine and atropine should prevent Ach-induced constriction of bronchiole smooth muscle. If anticholinergic activity is present in the extracts, a similar response should be seen. The initial results (n=4), show expected responses on the first exposure to both Ach and Epi and on the second exposure in ethanol control. Incubation with scopolamine and atropine prevented constriction, but incubation with the plant extracts has been inconsistent. Extracts were all obtained using the same methodology, but some variability among nightshade species could be due to the differing concentrations of anticholinergic substances within these species.

**Board 40 CHARACTERIZATION OF THE COMPOSITION OF BACTERIAL COMMUNITIES AND POTENTIAL PATHOGENS IN FIELD APPLIED BIOSOLIDS IN NORTH WEST OHIO. Damien J. Terry, dterry@utnet.utoledo.edu, Von Sigler, von.sigler@utoledo.edu, Issmat Kassem, ikassem@utnet.utoledo.edu, The University of Toledo, Dept of Earth, Ecological and Environmental Sciences, Laboratory for Microbial Ecology, MS # 604, Toledo OH 43606.**

The application of biosolids (sludge resulting from waste water treatment plants [WWTP] processing) to agricultural fields is a common practice in Ohio. Biosolids contain a vast variety of potential human pathogens, which may affect the community surrounding the fields. However, the microbial composition of biosolids might be variable depending on treatment regimes adopted in WWTPs, and is largely uncharacterized. The purpose of this study was to characterize the composition of bacterial communities and putative pathogens in biosolids generated from several WWTPs. Samples were analyzed for heterotrophic bacteria using R2A media, total coliforms and *Escherichia coli using* Rapid *E. coli* 2 media and *Staphylococcus spp.* using Baird Parker media. The results show that the number of bacteria and putative pathogens are significantly dependent on type of digestion treatment. Specifically heterotrophic bacteria (190,000 CFUs $g^{-1}$ vs. 1,796,667 CFUs $g^{-1}$), fecal coliforms (234,000 vs. 0 CFUs $g^{-1}$), *E. coli* (3,334 vs. 0 CFUs $g^{-1}$), and *Staphylococcus spp.* (68,000 vs. 3,166,667 CFUs $g^{-1}$) fluctuated significantly (t-test) when comparing biosolids from two different class B WWTP. Most WWTPs inspected showed a decrease in fecal coliforms and *E. coli* numbers, while *Staphylococcus spp*. numbers tended to increase. To conclude, the treatments adopted in class B

biosolid WWTP might impact gram negative bacterial pathogens (*E. coli*) but not gram positive bacteria (*Staphylococcus spp.*), because they are more resistant. However, not all *Staphylococcus spp.* are pathogenic, which warrants further investigation into the specific pathogenic *Staphylococcus spp.* (*S. aureus*) using DNA fingerprinting techniques such as denaturant gradient gel electrophoresis.

**Board 42 FARNESOL IS SENSED BY PILJ AND INHIBITS SURFACE MOTILITY IN *PSEUDOMONAS AERUGINOSA*. Tracy L. Collins, Tracy.Collins@notes.udayton.edu, Mary S. Connolly, Mary.Connolly@notes.udayton.edu, and Jayne B. Robinson, Jayne.Robinson@notes.udayton.edu, Dept of Biology, University of Dayton, 300 College Park, Dayton OH 45469-2320.**

*Pseudomonas aeruginosa* and *Candida albicans* both exhibit cell-to-cell communication through the use of quorum-sensing molecules (QSM) known as autoinducers. A large majority of quorum-sensing controlled genes in *P. aeruginosa* encode for virulence factors such as exoproteases and pyocyanin. Because there is a positive correlation between the presence of *P. aeruginosa* and *C. albicans* in opportunistic infections, we examined whether the QSM of one organism can affect the other. Previous research has shown that *P. aeruginosa* QSM cognate, 3-oxo-$C_{12}$ HSL, mimics *C. albicans* QSM cognate *E*,*E*-farnesol by preventing the conversion of yeast to mycelium. These results suggest that *P. aeruginosa* is capable of communicating with *C. albicans* through 3-oxo-$C_{12}$ HSL. In order to determine the effect of farnesol on *P. aeruginosa*, a population of cells were exposed to *E*,*E*-farnesol and AHL production was assessed using thin layer chromatography (TLC). TLC analysis revealed that *E*,*E*-farnesol substantially inhibited production of QSMs by *P. aeruginosa* cells. Because twitching and swarming motility are both quorum-sensing controlled in *P. aeruginosa*, we examined the effect of *E*,*E*-farnesol on each. Twitching and swarming motility were both decreased when cells were exposed to *E*,*E*-farnesol. In addition, *in-vivo* $^{3}$H-methylation of *P. aeruginosa* showed an increase in methylation of PilJ, a methyl-accepting chemotaxis protein, when cells were exposed to *E*,*E*-farnesol. Our results indicate that *E*,*E*-farnesol is sensed by *P. aeruginosa* through PilJ which regulates the Type IV pili signal transduction pathway.

**Board 44 INDUCTION OF PSEUDOMONAS AERUGINOSA BIOFILMS BY BACTERIOPHAGE. Amy E. Beumer, beumerae@notes.udayton.edu, Jayne B. Robinson, jayne.robinson@notes.udayton.edu, Biology Dept, 300 College Park, Dayton OH 45469-2320.**

Pseudomonas aeruginosa is an opportunistic pathogen that forms highly antibiotic resistant biofilms on implanted medical devices and in patients with cystic fibrosis. As more bacteria become resistant to traditional antibiotics new methods of treatment are being explored; one of these is phage therapy. Because bacteria come into contact with bacteriophage in almost all known environments they would be expected to have defense mechanisms, such as biofilm formation, against phage infection. If phage therapy is to be considered for treatment of P. aeruginosa infections the effects of phage exposure on biofilm formation must be determined. We examined biofilm formation by cells exposed in media to phage, D3 and D3112, at a range of multiplicities of infection. Biofilms with and without phage were allowed to form on polyvinyl chloride (PVC) wells, a material used to construct medical devices. Our results showed that exposure to bacteriophage resulted in an increase, or induction, of P. aeruginosa biofilm formation. This was determined by graphing the average amount of crystal violet staining on 12 wells as well as the standard deviation. Phage induction of biofilm formation was unaffected in a quorum sensing mutant as well as in mutants lacking functional flagella or pili. However, phages were not able to induce wild type levels of biofilm formation in sadB mutant cells. Additionally, we found that the addition of GTP, an inhibitor of c-di-GMP, a known regulator of biofilm formation and the transition from a planktonic to a sessile mode of growth in several gram negative bacteria, led to the inhibition of biofilm induction by phage. Thus phage induction of P. aeruginosa biofilm formation may involve c-di-GMP signaling.

**Board 45 DECREASING FALL RISK IN OSTEOPOROSIS PATIENTS IN PRIMARY CARE SETTING, USING NOVEL METHODS FOR SCREENING AND FOR PHYSICAL THERAPY FOLLOW-UP. Katherine A. Schwinn, kschwinn@wooster.edu, (Sharon E. Lynn, slynn@wooster.edu, David A. Shewmon, shewmod@ccf.org), College of Wooster, 1189 Beall Ave., Wooster OH 44691.**

The goal of this project is to improve the quality of treatment that elderly female osteoporosis patients receive from their primary care physicians. Unidentified instability can lead to increased fall risk in elderly osteoporosis patients. An already accepted method of assessing instability is the Get Up and Go test (GUGT); however it is lengthy and few doctors administer it. The objectives are to [a] validate the One-Legged Stance test (OLST) as a faster tool for assessing instability, and [b] to lengthen the beneficial effects of physical therapy by using a simplified set of post-therapy exercises and working with the subjects on compliance. Our hypotheses are [a] that a significant number of subjects will pass the GUGT test, but will fail the OLST, and [b] that women who continue performing home exercises after completion of standard physical therapy will maintain their stability improvement, whereas those who do not will show a decrease in stability. The OLST and the GUGT, both of which measure stability based on a time scale, will be administered to osteoporotic women age 65 and older. The women who fail the OLST will be randomly divided into two groups for the second phase of the trial. Each group will complete four weeks of standard physical therapy, however, the experimental group will complete an extra four weeks of simplified, home-based post-therapy exercises. Balance will be assessed using the Berg Balance scale at week 0, week 4, and week 8 for both the experimental and control groups.

**Board 46 MEASUREMENT TECHNIQUES FOR TRICLOSAN AND RELATED ANTIBACTERIAL AGENTS IN WATER AND WASTEWATER. Kathryn M. Froning, froninkm@notes.udayton.edu, (Rich Striebich, Striebich@udri.udayton.edu), University of Dayton, Chemical Engineering, 1079 Berryhill Road, Bellbrook OH 45305.**

Several types of antimicrobials and antibacterial additives are used in products ranging from hand lotions and sanitizers to children's toys and toothpaste. Triclosan [2,4,4'-trichloro-2'-hydroxydiphenyl ether], one common antibacterial agent, has been outlawed in some European countries due to its toxicity and persistence. Other compounds including Triclocarban [N-(4-chlorophenyl)-N'-(3,4-dichlorophenyl) urea] are similar in structure to pesticides and are also found in many consumer products. Ultimately, these products find their way into wastewater systems, which are not designed to remove such compounds. The goal here is to identify new and improved ways to detect low levels (parts per billion and parts per trillion) of these compounds. Our hypothesis is that these materials are entering the waste stream in increasing amounts, disturbing the river ecosystem and ultimately affecting drinking water quality (compounds may accumulate in the body). We are investigating advanced ways to extract organics from water including Solid Phase Microextration (SPME) and Stir-bar Extraction Technology (SBET) along with conventional liquid-liquid extraction. Analytical work must be conducted at levels below parts per billion (ppb) concentrations; to achieve these levels of detection we used advanced techniques of Gas Chromatography-Mass Spectrometry (GC-MS) and Multidimensional GC-MS. Results show that SPME can perform acceptable extractions of water at the 0-1 ppb level. Analysis of wastewater samples in the Dayton area to date has not indicated the presence of either of these compounds; however, lower level detection (parts per trillion, ppt) has been observed by other researchers. We continue to improve detection and extraction capability to be able to monitor these chemicals at the lowest level possible.

**Board 48 UNDERSTANDING THE ECOLOGICAL FACTORS ASSOCIATED WITH BURULI ULCER DISEASE IN GHANA, AFRICA. Henry Malm II, hmalm@depauw.edu, (M. Eric Benbow, markbenbow@depauw.edu), DePauw University, Dept of Biology, Greencastle, IN 46135.**

Buruli ulcer (BU) disease is formally described as *Mycobacterium ulcerans* infection, the third most prevalent mycobacterial disease in humans after tuberculosis (TB) and leprosy. The emergence of this disease has been associated with standing water bodies and other aquatic habitats recently affected by human land use changes. Several hypotheses about the transmission of *M. ulcerans* to humans have been proposed, with one being that biting aquatic insects may play a direct role, and that land use changes create the optimal conditions for *M. ulcerans* growth and movement among aquatic macroinvertebrates. The hypothesis of this study is that the macroinvertebrates of aquatic habitats in areas of high human BU incidence (endemic) will be significantly different (species richness and functional feeding groups, reflecting trophic status) from those habitats in areas with low BU incidence (non-endemic). Studies have begun on analyzing macroinvertebrate samples taken from 3 water bodies in each of these incidence areas of southern Ghana, Africa. This ongoing study involves the analysis of macroinvertebrate communities and water quality in relation to human disease incidence. Macroinvertebrate communities will be

assessed by calculating species diversity, functional feeding group ratios and other biotic indices that reflect water body trophic status. Preliminary water quality analyses of several variables indicate that water bodies in endemic areas are distinctly different compared to non-endemic areas. Additional multivariate statistics (e.g., CCA, PCA) will be used to analyze macroinvertebrate and water quality variables between endemic and non-endemic water bodies.

**Board 50 HETEROGENEOUS EXPRESSION OF LIPOPOLYSACCHARIDE ANTIGEN ON DIFFERENT CLINICAL ISOLATES OF *PSEUDOMONAS AERUGINOSA*. Sarah D. Smith, sdsmith@bgnet.bgsu.edu, (Roudabeh J. Jamasbi, rjamasb@bgnet.bgsu.edu), Bowling Green State University, Dept of Public and Allied Health, 338 N. Church St., Bowling Green OH 43402.**

*Pseudomonas aeruginosa* is a nosocomial pathogen, accounting for 10-15% of all hospital-acquired infections. Recently, the frequency and distribution of different serotypes of *P. aeruginosa* from the Medical University of Ohio were determined in our laboratory. The main objective of the current investigation was to determine the heterogenous expression of the lipopolysaccharide (LPS) antigen on different serotypes of *P. aeruginosa*. Initially serotyping was performed by the slide agglutination technique, using polyclonal antibodies generated against the original 17 serotypes International Antigenic Typing System (IATS). To further differentiate the isolates in each serogroup, the degree of LPS expression on each strain within a serogroup was investigated by an enzyme-linked immunosorbent assay (ELISA) using a serial dilution of each antibody. A T-test was used to find statistical significance of the data. In addition, an antimicrobial profile of each strain was determined by the Kirby-Bauer method using seven antibiotics frequently used against *P. aeruginosa*. Resistance to one or more of the antibiotics was shown by approximately 48% of all isolates. Serotype 0:11 was the most frequently encountered isolate. It also had the highest degree of antigenic heterogeneity and antibiotic resistibility.

**Board 52 THE INVOLVEMENT OF TWO NARL HOMOLOGUES IN *PSEUDOMONAS AERUGINOSA* DENITRIFICATION. Vandana Sharma sharmava@notes.udayton.edu, Chris E. Noriega noriegce@notes.udayton.edu, John J. Rowe, John.Rowe@notes.udayton.edu. University of Dayton, Dept of Biology, Dayton OH 45469-2320.**

Nitrate anaerobic respiratory pathways are subject to transcriptional regulation by anaerobiosis/oxygen and nitrate. The *Escherichia coli* system is the paradigm for transcriptional regulation of nitrate anaerobic respiration. Anaerobic transcriptional regulation is mediated by the FNR protein, and transcriptional regulation by nitrate takes place via dual interacting two-component regulatory systems, which consist of homologous membrane-bound sensors (Nar X and NarQ proteins) and homologous DNA binding response regulators (NarL and NarP proteins). In *Pseudomonas aeruginosa*, homologues of *narX* and *narL* were identified from the Pseudomonas genome database. Interestingly, this organism possesses two *narL* homologues namely PA3879 (*narL*) and PA2376 (*narL*II) but no similarity was found to NarQ. The *narX* and *narL* genes are adjacent to the *narK1K2GHJI* operon but are transcribed in the opposite direction. In order to confirm the metabolic function of these homologues a triple isogenic mutant of *Pseudomonas aeruginosa* was isolated and characterized. Genetically, the mutant was lacking in three genes: PA3878 (*narX*), PA3879 (*narL*) and PA2376 (*narL*II) and was created in two different backgrounds: PAO1 and MPAO1, respectively. Physiologically, the mutant was found to be defective in nitrate and nitrite dependent anaerobic growth and was void of nitrate reductase activity. On the other hand, the single mutants were not affected either in anaerobic growth or in nitrate reductase activity and were indistinguishable from the wild type. This phenotypic difference between the single and the triple mutant may be indicative of functional significance of both *narL* and *narL*II in *P. aeruginosa* denitrification.

**Board 54 TETRACYCLINE RESISTANCE AMONG *ESCHERICHIA COLI* ISOLATED FROM AGRICULTURAL AND RESIDENTIAL LOCATIONS IN NORTHEAST OHIO. Katherine M. Dilley[1], kdilley@wooster.edu, (Marilyn Loveless[1], mloveless@wooster.edu), Jeff LeJeune[2], lejeune.3@osu.edu, [1]The College of Wooster, C-1499, 1189 Beall Avenue, Wooster OH 44691, [2]Ohio Agricultural Research and Development Center.**

Contamination of the environment with antibiotic resistant bacteria is a growing public health concern. This study was conducted to determine if surface waterways draining dairy farms in NE Ohio were more likely to be contaminated with tetracycline resistant *E. coli* than waterways draining residential areas. Combined water and sediment samples were collected over a five-week period (Sept-Oct 2005) from three streams located near dairy farms and three streams located near residential areas. Samples were collected on days 0, 1, 7, 14, 21, and 28. Thirty *E. coli* isolates obtained from each location on each sample date were tested for resistance to tetracycline using the agar dilution method. Tetracycline-resistant *E. coli* were isolated only during the first week of study. The farm locations tested positive on 8/9 sampling occasions during the first week (prevalence values 3%-100%). Two of the three residential locations tested positive on sample day 1 (prevalence 3% and 11%). There were significant interactions between the source of the sample (farm vs. residential) and the day the sample was collected. Antibiotic resistant *E. coli* populations in stream sediments are spatially and temporally unstable and may be influenced by multiple factors including nearby sources of contamination, fluctuation in environmental conditions, and waste management at individual locations.

**Board 56 PA1785 IS REQUIRED FOR NITRATE AND NITRITE ASSIMILATION IN *PSEUDOMONAS AERUGINOSA*. Chris E. Noriega noriegce@notes.udayton.edu, Vandana Sharma sharmava@notes.udayton.edu, John J. Rowe John.Rowe@notes.udayton.edu. University of Dayton, Dept. of Biology, Dayton OH 45469-2320.**

Biological nitrate reduction plays a key role in global nitrogen cycling and occurs via two physiologically and genetically distinct metabolic pathways, nitrate respiration and nitrate assimilation. Nitrate respiration results in the generation of energy anaerobically through the use of nitrate as a terminal electron acceptor for membrane mediated respiration while nitrate assimilation ultimately involves the incorporation of nitrogen into amino acids which are subsequently used in the synthesis of proteins and nucleic acids. Many prokaryotes and eukaryotes are capable of assimilatory nitrate reduction but recent detailed studies have been limited in the environmentally and biomedically significant bacterium *Psuedomonas aeruginosa*. The Pseudomonas Genome Database has identified two open reading frames (PA1785 and PA1786) as potentially involved with either transport or regulation of assimilatory nitrate and nitrite reduction in *P. aeruginosa* PAO1. PA1785 encodes for a protein that has 96% similarity to *Azotobacter vinelandii* NasT protein which is involved with regulation of nitrate and nitrite assimilation. PA1786 encodes for a protein that has 69% similarity to the nitrate transporter NasF in *Klebsiella pneumoniae* and 76% similarity to another regulatory protein NasS in *A. vinelandii*. This study was aimed at experimentally confirming and clarifying the potential roles of these proteins in the assimilation of nitrate. Deletion of the two open reading frames disrupted the organism's ability to assimilate both nitrate and nitrite. PA1785 alone is sufficient to rescue the mutant phenotype. Thus, PA1785 is required for both nitrate and nitrite assimilation in PAO1, while PA1786 is not required for either.

**Board 58 HYDROPHOBIC HELICES IN THE LACTOSE PERMEASE PLAY A ROLE IN PROTEIN STABILIZATION BASED ON MUTANT CHARACTERIZATION IN HELICES VI, IX AND XII. Erin M.E. Scott, erin.scott@otterbein.edu, Jeremy Davis, jeremyd143@aol.com, Ashika Nanayakkara, ananayal@jhem.jhmi.edu, Amy E. Jessen-Marshall, ajessen-marshall@otterbein.edu, Otterbein College, SMC 10952, Westerville OH 43081.**

The lactose permease symport protein in *Escherichia coli* is a model system for the study of transport in bacteria. Based on the crystal structure deduced in 2003 it has been shown that eight helices line the inner channel with four anchoring helices III, VI, IX and XII. We propose that the hydrophobic helices function as stabilizers for the inner helices and play an important role in the structural integrity of the protein. Site directed mutagenesis of amino acids in each of these hydrophobic helices has been completed, introducing amino acid changes in size and or charge. Substitutions of L183F in Helix VI, A309E in Helix IX and T393A in Helix XII all show an impact on lactose permease structure and function. Qualitative analysis on MacConkey agar plates through three trials of replica plating shows reduced activity based on a white phenotype compared to the wild type red phenotype. Quantitative analysis using O-Nitro-Phenyl-Galactoside spectrophotometric assays to determine transport rates shows that L183F functions at only 78% wild type, while others such as T393A have a more severe defect, functioning at 40%. Based on this work and previously reported work on helix III from our lab, the data supports a role for the hydrophobic helices in maintaining the structure of the protein, since mutations in these helices result in decreases transport function.

**Board 60 DETERMINING THE FREQUENCY OF EXTRA-PAIR PATERNITY IN TWO SOUTH-CENTRAL WELSH POPULATIONS OF PIED FLYCATCHERS (*FICEDULA HYPOLEUCA*). Marliese A. Zimmerman, mzimmerman@wooster.edu, (Dean Fraga, dfraga@wooster.edu), The College of Wooster, 1189 Beall Ave., C-3085, Wooster OH 44691.**

Extra-pair paternity (EPP), the fathering of offspring outside of a social-pair bond, occurs with varying frequency both within and between avian species. Pied Flycatchers (*Ficedula hypoleuca*), a species of Eastern European songbird, exemplify within species EPP frequency variability as the literature indicates a range of 4-29% between studied Norwegian and Swedish populations, respectively. The purpose of this study is to determine the frequency of EPP occurring in two Welsh populations of Pied Flycatchers for the 2004 and 2005 breeding seasons and to determine the effects of environmental stresses on EPP frequency. Four microsatellite DNA markers are being utilized in the paternity analysis. DNA was extracted from blood samples collected from all adults and chicks present in both populations (N=658) and stored on Isocode cards. The extracted DNA was amplified through polymerase chain reaction (PCR) and separated by molecular weight using CEQ 8000 fragment analysis software. Paternity was determined based on the principles of Mendelian genetics with discrepancies in allelic inheritance from parent to offspring indicating EPP. Preliminary results for the 2004 breeding season indicate that the frequency of EPP, measured as the percentage of extra-pair chicks, for the Welsh populations is at least 30%, but may be as high as 60%.

**Board 62 INFLUENCE OF THE CYCLIN-DEPENDENT KINASE INHIBITOR P57$^{KIP2}$ ON MOUSE PREOSTEOBLAST DIFFERENTIATION. Michelle E. Carroll, carrolmy@notes.udayton.edu, (Marie-Claude Hofmann, Marie-ClaudeHofmann@notes.udayton.edu), Dept of Biology, The University of Dayton, 300 College Park, Dayton OH 45469-2320.**

This research investigates bone stem cell differentiation. In an adult, the bone stem cells are called osteoprogenitors; they are derived from pluripotent mesenchymal stem cells found in the bone marrow. Osteoprogenitor cells, regulated by growth factors, steroid hormones or other similar cell mediators, can mature into preosteoblasts. Preosteoblasts, with proper signaling, can differentiate to become osteoblasts—cells producing the bone extracellular matrix components such as type I collagen. Previous research done in our lab has provided evidence that the overexpression of p57$^{kip2}$ ,a cyclin-dependent kinase inhibitor protein, leads to differentiation of preosteoblasts into osteoblasts. However, none of the molecular events downstream of p57$^{kip2}$ are known. The goal of this study is to identify genes differentially regulated by p57$^{kip2}$ in preosteoblasts. This will help to uncover signaling pathways and the associated proteins that may contribute to preosteoblast differentiation. In order to identify those genes, a bone-related macroarray assay will be used to simultaneously measure the expression levels of 25 bone-specific genes. Already, the p57$^{kip2}$ plasmid was amplified in *Eschirichia coli* and the purified DNA transfected into MC3T3-E1 mouse preosteoblast cells. Three days after transfection, RNA was isolated from these cells for the macroarray assay. The macroarray data is being analyzed and will be confirmed with semi-quantitative RT-PCR analysis. Unraveling the molecular mechanisms driving osteogenesis is particularly important to understand and cure osteoporosis and bone cancer.

**Board 64 PHYLOGENETIC SHADOWING OF THE *HOMO SAPIENS* AND *PAN TROGLODYTES* DPA/DPB CONTROL REGION OF THE MAJOR HISTOCOMPATIBILITY COMPLEX. Teresa R. Young, teresa.young@otterbein.edu, (Simon Lawrance, slawrance@otterbein.edu), Dept of Life & Earth Sciences, Otterbein College, Westerville OH 43081.**

The publication of the draft chimpanzee genome makes it possible to identify and understand the genetic factors that contribute to the many differences between *Homo sapiens* and our closest living evolutionary relative *Pan troglodytes*. Some differences such as language and bipedalism are more obvious, while others such as susceptibility to disease are more subtle. The goal of this research is to compare the *Homo sapiens* and *Pan troglodytes* DPA/DPB control regions in the major histocompatibility complex (MHC). The DPA and DPB genes play an important in susceptibility and resistance to auto-immune and infectious diseases. Our specific objectives are 1) to use phylogenetic shadowing, which is the alignment of several closely related genomes, to identify the sequences responsible for regulation of the MHC DPA and DPB genes, and 2) to identify human specific single nucleotide polymorphisms (SNPs) that may contribute to human/chimp differences in DPA and DPB gene expression. The two methods being used are the polymerase chain reaction and DNA sequencing. To date, several candidate SNPs have been identified and are being resequenced to confirm their identity. Once the phylogenetic shadowing is complete, the influence of each nucleotide differences can be tested using reporter gene assays.

**Board 66 *IN VITRO* BEHAVIOR OF MOUSE SPERMATOGONIAL STEM CELLS IN THE PRESENCE OF JAGGED1 AND GDNF. Natalia Kostereva, kosternv@notes.udayton.edu, Marie-Claude Hofmann, Marie-Claude.Hofmann@notes.udayton.edu, Dept of Biology, Sciences Center, University of Dayton, Dayton OH 45469-2320.**

Unraveling the processes that regulate cell fate decision in spermatogonial stem cells (SSCs) is essential to understand the first steps of spermatogenesis. Previous data from our laboratory have demonstrated that the expression of Numb, an antagonist of Notch-1, is up-regulated in SSCs treated with glial cell line–derived neurotrophic factor (GDNF). The Notch-1 receptor is found in SSCs and the ligands for this receptor, Jagged1 and Jagged2, are expressed by Sertoli cells. We are proposing that the balance between Jagged1 and GDNF affects the behavior of these cells (proliferation versus differentiation). To test this hypothesis in vitro, purified SSCs derived from 5-6 day-old mice (n=180) were cultured in 96-well plates at densities of $1x10^4$ cells per well in 200 µl StemPro-34 medium with Jagged1 (0-20ug/ml) and GDNF (0-100ng/ml) at inverse concentrations. Cell response was evaluated by counting the number of cell colonies and chains of differentiated spermatogonia (called $A_{aligned}$ cells) at Days 3 and 7. After the final count the cells were enzymatically collected for qRT-PCR. The two-sample t-test as implemented in MS Excel was used to determine statistical significance of observed differences in the mean values ($P<0.05$). For in vitro culture assay with growth factors, each data point represents the average of three experiments. SSC cultures with Jagged1/GDNF mixture (n=12) showed a higher number of differentiated spermatogonia (x1.5) than cultures with GDNF only ($P<0.05$). Our data indicates that GDNF is a stimulator of colony formation, while Jagged1 promotes proliferation into colonies and differentiation into chains of $A_{aligned}$ spermatogonia. Thus, the balance between these two factors is important to determine spermatogonial stem cell fate.

**Board 68 INVESTIGATING THE VOLTAGE-GATED $Ca^{2+}$ ION CHANNEL REGULATION FUNCTION OF THE PP2B GENE IN *PARAMECIUM TETRAURELIA* THROUGH THE USE OF RNA INTERFERENCE. Katelin M. Bugler, Kbugler@wooster.edu, (Dean Fraga, Dfraga@wooster.edu), The College of Wooster, 1189 Beall Avenue, Box C-1284, Wooster OH 44691.**

Protein phosphatase 2B (PP2B) is involved in the regulation of voltage-gated $Ca^{2+}$ ion channels in a multitude of systems. The purpose of this study is to determine if this function is also true in *Paramecium tetraurelia*. A *P. tetraurelia* mutant known as *Dancer* will also be used because they have a mutation that causes a failure to properly inactivate the $Ca^{2+}$ ion channel and may help accentuate a role for PP2B. In order to determine the function of the PP2B gene, RNA interference (RNAi) will be used to target the PP2B mRNA sequence. To test the effects of the RNAi, behavioral assays in a KCl solution will be used to observe swimming behavior in wild type and *Dancer* cells. The duration of backward swimming is indicative of the length of time the $Ca^{2+}$ ion channel is open, giving insights into the role of PP2B in regulating ion channel function. It is hypothesized that if PP2B is regulating the voltage-gated $Ca^{2+}$ ion channels, then the duration of backward swimming should be longer in the cells that have had PP2B down-regulated. The specificity of the RNAi targeting will be assessed using a Real-Time Polymerase Chain Reaction. Preliminary results have shown that the *Dancer* cells with PP2B down-regulation engage in backward swimming behavior for a significantly longer period of time compared to the control groups, whereas wild type cells remain unaffected, suggesting an interesting interaction between the *Dancer* mutation and PP2B (ANOVA test, $p=0.000$).

**Board 70 TRANSPLANTATION OF IMMORTALIZED GERM CELLS. Tiffany Carnes[1], carnestm@notes.udayton.edu, Natalia Kostereva[1], kosternv@notes.udayton.edu, Jinping Luo[2], jinping@vet.upenn.edu, Martin Dym[3], dymm@georgetown.edu, Ina Dobrinski[2], dobrinsk@vet.upenn.edu, Marie-Claude Hofmann[1], Marie-Claude.Hofmann@notes.udayton.edu, [1]Dept of Biology, University of Dayton, 300 College**

**Park, Dayton OH 45469-2320, [2]School of Veterinary Medicine, University of Pennsylvania, [3]Georgetown University Medical Center.**

The ability to use a cell line for transplantation studies could greatly improve our knowledge of spermatogenesis and provide a new way to produce transgenic animals. Spermatogenesis is a complex, well-organized process that starts with the self-renewal and differentiation of germline stem cells. These stem cells express on their surface a multicomponent receptor made of two proteins, Ret and GFRα-1, that bind a growth factor called glial cell line-derived neurotrophic factor (GDNF). The molecular mechanisms driving the first steps of spermatogenesis are poorly understood. This is due to the fact that only a limited number of cells can be isolated, and that germline stem cells have a limited viability in culture. To overcome this problem, our lab has established a cell line derived from mouse spermatogonia, C18-4, which exhibits stem cell characteristics such as the GFRα-1 and Ret proteins. To investigate the stem cell capacity of this cell line, which is the ability to repopulate an infertile testis and reconstitute spermatogenesis, we used a transplantation assay. Fifty thousand C18-4 cells were transplanted into one of the testes of six recipient mice (nude, Nu/Nu) previously treated with busulphan to destroy endogenous spermatogenesis. Non-transplanted contralateral testes were used as negative controls and freshly isolated GFRα-1 positive stem cells transplanted into the testes of six sterile mice were used as positive controls. So far, the data has shown that two months after transplantation, the C18-4 cells colonized 42% of the seminiferous tubules of the recipients, but no cellular differentiation has been observed. The ability to use a cell line for transplantation studies could greatly improve our knowledge of spermatogenesis and provide a new way to produce transgenic animals.

**Board 72 ASSOCIATIVE EFFECTS AND TRANSIT TIME IN JUVENILE FRESHWATER TURTLES.** **Amber K. Murphy, amber.murphy@otterbein.edu, (Sarah S. Bouchard, Sbouchard@otterbein.edu), Otterbein College, SMC 12743, One Otterbein College, Westerville OH 43081.**

During development, freshwater turtles experience an ontogenetic shift from carnivory to herbivory. As they transition between diets, they consume mixed diets of different plant and animal ratios, which is known to produce associative effects in adults. Associative effects occur when diet items interact with each other so total energy gained is more or less than predicted based on gains from pure diets. In this study, hatchling slider turtles, *Trachemys scripta*, were used to determine the presence of associative effects in juveniles and whether their cause is related to differences in transit time between diet items. It was hypothesized that adding plant material to an animal diet could increase transit time, and therefore digestibility. Conversely, adding animal material to a plant diet could decrease transit time and digestibility. Fifty juveniles were divided into five groups and maintained for six weeks on either: 100% duckweed, *Lemna minor*, 100% cricket, *Acheta domesticus*, or one of three mixed diets containing 33.8% duckweed and 66.2% cricket, 60.6% duckweed and 39.4% cricket, and 79.1% duckweed and 20.9% cricket, dry mass basis. Growth rates and transit times were measured. Growth of turtles on the 20.9% cricket diet reflected a negative associative effect, attributed to the shorter mixed diet transit time relative to the 100% duckweed diet, allowing less time for fermentation. No associative effects were found in the other two mixed diets. The absence of positive associative effects formerly observed in adults may be attributed to the especially high digestibility of animal matter in juveniles previously documented.

**Board 74 THE EFFECTS OF DIET ON MICROBIAL POPULATIONS IN THE YELLOW-BELLIED SLIDER TURTLE, *TRACHEMYS SCRIPTA*.** **Jennifer A. Berry, Jenna.Berry@Otterbein.edu, (Sarah Bouchard, S.Bouchard@Otterbein.edu, Amy Jessen-Marshall, A.Jessen-Marshall@Otterbein.edu), 204 W. Main St., Westerville OH 43081.**

Herbivorous vertebrates lack endogenous enzymes needed to break down cellulose and therefore must rely on microbial gut fermentation to digest plant material. Reptiles are the poorest studied group of vertebrates using microbial symbionts. The purpose of this study was to describe the microbial gut population in yellow-bellied slider turtles, *Trachemys scripta*, and to determine how microbial populations change with diet. This is especially important to understand in growing reptiles that need to maximize digestion for survival and future reproductive success. Fifty *T. scripta* hatchlings were obtained from a breeding farm in Louisiana. Their guts were inoculated with microbial symbionts by feeding feces from wild adult turtles. They were maintained on the following five different diets with ten turtles per diet: 100% duckweed; 79.1% duckweed/ 20.9% cricket, 60.6% duckweed/ 38.4% cricket, 33.8% duckweed/ 66.2% cricket, and 100% cricket. These diets represent plant to animal ratios turtles experience as they transition between carnivory to herbivory. It was hypothesized that species of microbes will differ between diets. Turtle feces were collected twice a week to analyze microbial population. EMB plates specific for gram positive bacteria and PEA plates specific for gram negative bacteria were used to grow colonies in candle jars to ensure an anaerobic environment. Isolated colonies were tested for enzymatic activity using Enterotubes that test metabolic products. Preliminary analyses indicate that gut microbial populations vary among diets. Approximately eleven morphologically distinct species were found. Further biochemical analyses will reveal genus and species, as well as their substrates for fermentation.

**Board 76 REDUCED SEED GERMINATION AFTER PAPPUS REMOVAL IN NORTH AMERICAN DANDELIONS, *TARAXACUM OFFICINALE*; ASTERACEAE.** **Alison N. Maye, s07.amaye@wittenberg.edu, Matthew H. Collier, mcollier@wittenberg.edu, Dept of Biology, Wittenberg University, Springfield OH 45501-0720.**

Fruit produced by apomictic (agamospermous) North American dandelions consists of an achene and an awn-like modification of the calyx called a pappus, which is known to facilitate seed dispersal. Based on previous work concerning dandelion seed germination (i.e., appearance of the radicle), it was hypothesized that pappus removal reduces seed germination in dandelions. To test this hypothesis, seeds from twenty different dandelion plants both with (N = 200) and without (N = 200) a pappus were placed in plastic tubs (34.4 cm x 21.4 cm x 11.5 cm) lined with Whatman paper (N = 20, one tub per plant) and allowed to germinate under a light bank (24 hour photoperiod) for a two-week period. Total numbers of germinating seeds both with and without a pappus were counted in each tub and totaled across tubs. Time to germination (number of days) over the two-week investigation was also recorded. Significant differences in mean total seed germination within tubs ($P < 0.0001$), total germination across tubs ($P < 0.0001$; total germinated with pappus = 91/200, total germinated without pappus = 52/200), and mean time to germination ($P < 0.0001$; time to germination with pappus = 3.92 days, time to germination without pappus = 5.10 days) were detected. These results suggest that seed germination in dandelions is reduced and time to germination is increased if the pappus is removed.

**Board 78 HISTOLOGICAL TOOLS FOR ASSESSING STEM TISSUE VIABILITY AND TRACING HERBICIDE INFLICTED DAMAGE IN INVASIVE WOODY PLANTS.** **Mark A. Fuchs, fuchsmaa@notes.udayton.edu, Donald R. Geiger, donald.geiger@notes.udayton.edu, University of Dayton, Dept of Biology, Dayton OH 45469-2320.**

Since their introduction, non-native invasive shrubs have largely contributed to the decline in native plant biodiversity in forests of the eastern United States. In an attempt to discern the efficiency of herbicidal control, ten recognized visible and fluorescent viable biological dyes were evaluated for their ability to distinguish living tissues within intact woody plant stems. Using a novel hand-sectioning technique and compared against standard histochemical staining procedures (i.e. phloroglucinol, aniline blue, safranin) the condition of stem cross-sections from 9 non-native invasive and 8 native plant species common to the eastern and mid-western United States was assessed for anatomical structure, metabolic activity and tissue viability. Viewed with light, fluorescent and scanning electron microscopy, only stems stained with 2,3,5-triphenyltetrazolium chloride (TTC) or 6-carboxyfluorescein diacetate (CFDA) when compared against unstained tissue specifically were capable of identifying living and metabolically active tissues within the primary xylem, xylem rays and phloem (n = 10 stems per plant species). Employing these techniques in plants treated with foliage sprays of the herbicide Roundup®, it was qualitatively possible to discern the site and trace the extent of tissue death throughout the shoot. Although anatomically different in structure, the compression of the living phloem band occurred similarly in stems of all plant species studied. Even in the absence of visible external symptoms, cross-sectioned viability staining of herbicide treated stems revealed a loss of cellular integrity that worsened with time. This technique is currently being investigated as a method for evaluating management practices in hard to control invasive woody plants.

**Board 80 THE SPREAD OF THE INVASIVE SHRUB, *LONICERA MAACKII* (AMUR HONEYSUCKLE)**

**AROUND GREATER DAYTON, OHIO. Mary K. Roberts, robertmk@notes.udayton.edu, Donald Geiger, donald.geiger@notes.udayton.edu, Sudhindra R. Gadagkar, gadagkar@notes.udayton.edu, Dept of Biology, University of Dayton, Dayton OH 45469-2320.**

The Amur honeysuckle (*Lonicera maackii*) was brought into arboretums in North America from its native northeast Asia approximately 100 years ago. However, it quickly escaped cultivation and became invasive, spreading and displacing native flora in eastern United States and parts of Canada. Nevertheless, genetically improved varieties of this shrub were officially promoted for the purposes of preventing soil erosion and providing food for wild birds. Today, it is considered noxious in at least 24 states in eastern United States. This study was undertaken to determine the direction and extent of spread of the honeysuckle around the Greater Dayton area, focusing mainly on the role of disturbed areas, particularly roadways, in aiding its dispersal. All major and many minor roadways were examined in the area radiating out of the city of Dayton. Tissue samples (for later DNA work) were taken from 22 locations, with geographical coordinates determined using a portable GPS unit. Out of these, "fronts" were seen in six locations. For example, the plant appears to quickly disappear north of downtown Dayton with the front approximately 55 km away on I-75 near Sidney, Ohio. In the northeast direction, the front is about the same distance away along US 68 near Urbana, Ohio. Other fronts were noted too. Interestingly, however, there appears to be no front in the south and southwest directions, suggesting that Dayton perhaps obtained its population of honeysuckle from an advancing front from the Oxford, Ohio area where it was deliberately introduced in the 1960's.

**Board 82 APPLICATION OF THE QBR INDEX TO THE RIPARIAN FORESTS OF SEVERAL CENTRAL OHIO STREAMS. Stephanie R. Colwell, colwell.19@osu.edu, (David M. Hix, hix.6@osu.edu), The Ohio State University, School of Natural Resources, 2710 Amity Rd., Hilliard OH 43026.**

Riparian forests are one of the most threatened ecosystem types in the world. There is a need to develop an ecological index of the quality of the riparian habitat. The QBR index ('Qualitat del Bosc de Ribera', or in English, 'Riparian Forest Quality') was developed to score the quality of habitat in Mediterranean riparian areas. We have modified the QBR index for use in Central Ohio, and suggest guidelines for adapting it for use in other portions of North America. The specific objectives of this project were to alter terms and requirements of the index that are region-specific to Spain, to develop lists of native and non-native tree and shrub species found in riparian forests in Central Ohio, and to test the altered index in three study watersheds in Ohio (Big Darby, Little Darby, and Walnut Creek watersheds). There are four parts to the QBR index: total riparian cover, cover structure, cover quality, and channel alterations. Sixty study sites were chosen for testing this index, 20 within each watershed. In these sixty sites, 39 total tree species were recorded with 21 common tree species (occurring in greater than 20% of the sites in any one watershed). One non-native tree species, seven common native shrub species (twenty-three total), and two common non-native shrub species (four total) also were identified. With our modified index, the Big Darby had the most high-quality sites with scores $\geq$95, while the Little Darby had the most poor-quality sites with scores of $\leq$50.

**Board 84 VEGETATION CHANGES AT FORT HILL, HIGHLAND COUNTY, OHIO SINCE E.LUCY BRAUN STUDIES IN THE 1960'S. Robert M. Altenau altenarm@notes.udayton.edu, Kelly Williams, kelly.williams@notes.udayton.edu, Dept of Biology, University of Dayton, 300 College Park, Dayton OH 45469-2320.**

In 1923 Dr. E. Lucy Braun made her first visit to Ft Hill in Highland County Ohio. In 1969 the Ohio Biological Survey published "An Ecological Survey of the Vegetation of Fort Hill State Memorial, Highland County, Ohio" that emphasized the pronounced differences in aspect and composition of plant communities in the area. Braun's study serves as a base line for vegetation change. In 2004 the vegetation plots of Dr. Braun were re-sampled to determine if vegetation changes had occurred. Sample plots were located from published maps and from unpublished field notes at the Cincinnati Museum of Natural History Library. Each plot was 66 feet square (0.1 acre). Tree species, abundance and size (greater than one inch DBH) were measured in each of 15 plots. Soil samples were measured for pH. Importance values (relative density + relative dominance) were measured. The dominant two species of five species total in each sample plot accounted for 74% of the dominance in both studies. Of the 15 plots, five had an identical order of dominance, four had the first dominant the same, three plots showed a dominance switch, two plots had the same second dominant species and one plot had no species in common. The dominant trees were American beech (*Fagus grandifolia*) sugar maple, (*Acer saccharum*), red maple (*A. rubrum*), chestnut oak (*Quercus montana*, and red oak (*Q. rubra*). These trees were distributed along an elevational gradient from Baker Fork (800+ feet) to the top of Ft Hill (1200+ feet). Geologically the lower elevation is dominated by Peebles Dolomite. Most of Ft Hill is underlain by Ohio Black Shale and the summit is Berea Sandstone. Soil pH values averaged 6.2 (n =5) in the Dolomite, 5.2 (n=7) in the Shale and 6.3 (n = 3) in the Sandstone. American Beech trees dominated on the Dolomite, chestnut oak on the Shale and sugar maple and red oak on the Sandstone. The pattern of plant distribution and abundance was similar to that in the previous study.

**Board 86 A COSMID LIBRARY OF *RHIZOBIA*. Avrita Singh, singh_a@denison.edu, (Sarah Bashore, bashores@denison.edu), Denison University, 2399 Slayter Box, One Main St., Granville OH 43023.**

A previously identified bean (*Phaseolus vulgaris*) mutant which inhibited root nodulation by *Rhizobium spp.* was observed to be nodulated by two strains, *Rhizobium leguminosarum* USDA 9041 and *R. leguminosarum* USDA 9017. These two rare strains were classified as "overcoming," due to their ability to fix nitrogen in both the mutant and wildtype bean. The majority of *Rhizobium spp.* are capable of nodulating only the wildtype bean and are termed as "restricted." In order to understand the genomics behind this mechanism, a cosmid library of the overcoming strains was created using *pLAFR*. The library was inserted into a restricted strain, *R. leguminosarum* USDA 2669 and inoculated onto the mutant (N=6) and wild-type bean (N=5). Root nodulation was monitored and any nodules that formed on the mutant host were collected and the cosmid was isolated and sequenced. A genetic analysis of this symbiotic process will allow for recognizing plant factors and receptors which regulate an esoteric nodulation mechanism by *Rhizobium*.

**Board 88 ABSENCE OF A ROLE FOR FUNGAL ASSOCIATES IN GERMINATION OF NORTH AMERICAN DANDELIONS, *TARAXACUM OFFICINALE*. Joshua A. Mancini, s07.jmancini@wittenberg.edu, Megan E. Bardgett, s06.mbardgett@wittenberg.edu, Alison N. Maye, s07.amaye@wittenberg.edu, Jay A. Yoder, jyoder@wittenberg.edu, Matthew H. Collier, mcollier@wittenberg.edu, Dept of Biology, Wittenberg University, Springfield OH 45501.**

Dandelion seeds, *Taraxacum officinale*, were analyzed for the presence of endosymbiotic fungi followed by germination studies with an antimycotic to examine the importance of fungal associates for growth and development. Seeds were collected from 25 different plants and four different populations in Springfield, OH (August 2005). To evaluate internal mycoflora, seeds were surface-sterilized, sectioned and covered with molten potato dextrose agar. External isolates were recovered from seeds that were not sterilized. *Cladosporium cladosporioides* was the lone internal isolate with a recovery rate > 90% in all four populations (97/100, 92/100, 95/100 and 93/100). Fungi recovered from the external surface consisted of an array of Deuteromycetes (*Penicillium*, *Aspergillus*, *Scopulariopsis*) and Zygomycetes (*Rhizopus*, *Mucor*, *Absidia*) that varied qualitatively and quantitatively with soil setting. Because *C. cladosporioides* was the sole internal fungus, germination studies focused on this fungus. Anticipating that *C. cladosporioides* is necessary for germination, an antimycotic was topically applied to seeds (N=100) that were then placed onto moist filter paper and examined every 12h for the appearance of a radical as evidence of germination. Internal isolations of antimycotic-treated seeds (N=100) revealed that no fungi were present inside, confirming our technique was appropriate. No delay of germination (7+2 days) or reduction in the number of seedlings (45+12% germination) was noted between antimycotic- and water-treated controls (ANOVA; $P>0.05$), suggesting that germination does not rely on internal mycotrophy. Thus, local mycoflora does not appreciably impact the spread of dandelions into new geographic regions, nor does it seem feasible to target internal fungus in biological control tactics.

**Board 90 ECOLOGY AND EVOLUTION OF THE PLANT GENUS *IMPATIENS* IN AFRICA. Mary L. Granger, grangeml@notes.udayton.edu, Bryan A. Anthony, anthonba@notes.udayton.edu, Sudhindra R. Gadagkar, gadagkar@notes.udayton.edu, Dept of Biology, University of Dayton, 300 College Park Ave., Dayton OH 45469-2320.**

The genus *Impatiens*, with a worldwide distribution of 500-1000 species, enjoys wide popularity as a garden plant, and is a staple of commercial nurseries. Apart from its economic value, however, this genus is also of considerable biological interest, displaying unusual traits such as cleistogamy (closed flowers) and chasmogamy (open flower) in the same plant. These plants have also become invasive in certain parts of the world by evolving insect attractants such as the most nutritious and sweet-smelling nectar in its habitat. As part of a larger study to study the evolution of this genus worldwide, information was gathered from a published book on 96 morphological and ecological traits for 55 species of African *Impatiens*. Since most species exhibited considerable plasticity in many traits, the maximum and minimum values were also noted for such traits. The maximum parsimony method was then used to infer evolutionary relationships among these plants using the collected character data. This yielded a tree that generally grouped species that belonged to a given geographical region (northern, central, etc.) and habitat type (plateau, mountain, etc.). However, no significant differences were found among regions or habitat types for traits such as plant height or leaf area, although the maximum leaf area differed significantly ($p < 0.01$) among habitat types, with the lowland-plateau showing the largest leaf area (91 $cm^2$). It is anticipated that with more trait data becoming available for these and other *Impatiens* species, such a study will help shed more light on character evolution in this genus.

**Board 92 CHANGES IN CELL WALL ULTRASTRUCTURE DURING VASCULAR CAVITY FORMATION IN PEA PRIMARY ROOTS. Purbasha Sarkar, sarkarp@muohio.edu, Daniel K. Gladish, gladisdk@muohio.edu, Miami University, Dept of Botany, Oxford OH 45056.**

Primary roots of pea (*Pisum sativum*), when grown under hypoxic conditions created by flooding at 25°C, rapidly form a long cavity in the central vascular tissue by lysigeny. Vascular cavity might be a form of inducible aerenchyma that provides a conduit for oxygen. Aerenchyma formation in cortex of maize and *Sagittaria* roots involves programmed cell death (PCD). Cavity formation in pea roots may also be PCD because the deaths are confined to specific cells and presence of full-length cavities allow continued growth of the roots during flooding stress. The cells that lyse to form vascular cavities undergo profound thinning of their walls. Changes in the localization pattern of cell wall pectins is a feature of flooding induced aerenchyma formation in maize. For the current study, the distribution pattern and abundance of esterified and de-esterified pectins in the walls of affected pea root cells were studied. This was done by *in situ* immunolabeling with anti-pectin antibodies (JIM5 and JIM7) followed by transmission electron microscopy. For each treatment, at least 25 cells from three different roots were analyzed. The mean number of de-esterified pectins per unit area in the cell walls did not change but esterified pectins were reduced by 40% (Student's two-tailed t-test; P=0.058) in roots grown in flooded conditions at 25°C compared to unflooded controls. This reduction in esterified pectins is consistent with the thinning of cell walls during cavity formation, and, if it can be shown that the change is under active regulation, it will be indicative of PCD.

**Board 94 WHOLE GENOME COMPARISON OF H1N1 AND H3N2 INFLUENZA A VIRUSES. Bhakti Dwivedi, dwivedbz@notes.udayton.edu, Sudhindra R. Gadagkar, gadagkar@notes.udayton.edu, Dept of Biology, University Of Dayton, 300 College Park Ave, Dayton OH 45469-2320.**

Previous influenza A viral pandemics in humans have been attributed to human-specific strains of certain viral subtypes (e.g., H1N1 in 1918) and to genetic re-assortment between avian and human strains of the virus (e.g., H2N2 in 1957 and H3N2 in 1968). This research was undertaken to determine if certain segments (particularly HA and NA, which are critical in ensuring successful infection) were undergoing rapid change in the subtypes, H1N1 and H3N2. DNA sequences were obtained from NCBI and comparative sequence analysis done for each of the eight genomic segments for the following pairs of subtypes/strains (H = Human; A = Avian): H-H1N1 & A- H1N1, and H-H3N2 & A-H1N1. Furthermore, comparisons were also made between collections from two different time periods for the same strain to study any changes over time. The results show that the HA and NA segments are both undergoing purifying selection, with the $d_N$-$d_S$ ratio (ratio of amino acid changing substitutions to neutral substitutions) <1 in all the comparisons (range: 0.09-0.93). On the other hand, the PB1-F2 gene, which induces apoptosis, is under positive selection in the avian H1N1, with a $d_N$-$d_S$ ratio >1 (1.5-2.4), and the evolutionary (substitution) pattern is changing in segment PB2 over time, as determined by the Disparity Index test ($I_D$= 0.25). These results show that it may be necessary to keep a close watch on segments other than HA and NA as well, in order to prepare for a mutation that would render the avian strain capable of transmission among humans.

**Board 96 ANURAN DISTRIBUTION IN THE FRAGMENTED FOREST HABITATS IN THE TILL PLAINS REGION OF WESTERN OHIO. Kelly D. Sowers, sowerskd@notes.udayton.edu, Catherine B. Schoenharl, schoencb@notes.udayton.edu, Kelly Williams, kelly.williams@notes.udayton.edu, Dept of Biology, University of Dayton, 300 College Park, Dayton OH 45469-2320.**

This project investigated the distribution of anurans (frogs and toads) in the glacial till plains region of western Ohio in relation to fragmented habitats and environmental characters. Forests in this region of Ohio are strongly fragmented as a consequence of agricultural practices. Forest fragmentation separates woodland breeding anuran populations eliminating or reducing genetic exchange thus increasing the risk of extinction. Anurans were sampled in 15 counties in western Ohio. Aquatic habitats were characterized as a vernal pool, permanent pond or wetland. Each breeding site was mapped with global positioning system (GPS) technology. Anuran populations were surveyed in woodland and prairie ponds in the spring and summer of 2004 and 2005. Adult presence was determined by listening for species specific vocal calls and by visual observation. Tadpoles were collected by dip netting and preserved in alcohol. The degree of habitat fragmentation in relation to specific breeding ponds was measured using ArcGis. Water depth, size, permanence, vegetative cover and water quality (pH) were measured. The Bullfrog (*Rana catesbeiana*), Green Frog (*Rana clamitans*), Northern Leopard Frog (*Rana pipiens*) and American Toad (*Bufo americanus*) were very widely distributed and have adapted well to forest fragmentation. Permanence of water was required for the Bullfrog, the Green Frog and the Leopard Frog. The American Toad occurred in all environments. The Gray Tree Frog (*Hyla versicolor*) did not occur in open ponds without trees. Species under decline that were not collected were Blanchard's Cricket Frog (*Acris crepitans blanchardi*) and the Wood Frog (*Rana sylvatica*).

**Board 98 THE INFLUENCE OF DIET ON ANTIMICROBIAL PEPTIDE DEFENSE AGAINST CHYTRIDIOMYCOSIS IN TIGER SALAMANDERS, *AMBYSTOMA TIGRINUM*. Meredith A. Boley, boleyma@muc.edu, (Brandon Sheafor, sheafobr@muc.edu), Mount Union College, 1972 Clark Ave., Alliance OH 44601.**

Chytridiomycosis is an emerging infectious skin disease of amphibians that has been implicated in the decline of amphibian populations in Australia, the Americas, Africa and Europe. It is caused by the fungal pathogen *Batrachochytrium dendrobatidis*. Amphibians rely on their skin for many important physiological functions, including osmoregulation and gas exchange. Therefore, their skin cannot become compromised by cutaneous infections without suffering negative physiological consequences. Antimicrobial peptides (AMPs) produced by granular skin glands are an amphibian's primary means of defense against skin pathogens such as *B. dendrobatidis*. These 10-50 amino acid residues are cationic, hydrophobic molecules that disrupt the membranes and/or metabolic functions of microbial cells. This project will examine the role diet plays in AMP production and effectiveness against *B. dendrobatidis*. Adult tiger salamanders (*Ambystoma tigrinum*) will be placed in groups of five and provided a diet of either mealworms, red worms, or crickets for a four-month period. Peptides will then be extracted by placing each group in a collecting buffer containing norepinephrine to stimulate AMP release. Peptides will be filtered from the collecting buffer using C-18 sep-pak filters, eluted, dried and reconstituted. The crude peptide mixture will be assayed against *B. dendrobatidis* to test for fungal growth inhibition. Preliminary results show that AMPs collected from crickets will produce the most effective AMPs. Consequently, we hypothesize that salamanders fed crickets will demonstrate the highest antimicrobial activity. As resources permit, peptides will be subjected to one and two-dimensional gel electrophoresis to examine molecular differences due to diet in salamander skin secretions.

**Board 100 ANTI-PREDATOR BEHAVIOR IN CRICKET FROG (*ACRIS CREPITANS BLANCHARDI*) TADPOLES. Leah J. Mycoff, lmycoff@wooster.edu, Richard M. Lehtinen, rlehtinen@wooster.edu, The College of Wooster, Box C-2289, Beall Ave., Wooster OH 44691.**

Blanchard's cricket frogs (*Acris crepitans blanchardi*) are able to reproduce in water bodies dominated by fish predators. An attempt was made to identify which anti-predator strategies (if any) are utilized by *A. crepitans* tadpoles to avoid predation by fish. A test

for predator preference was performed by pairing an *A. crepitans* tadpole with an unpalatable green frog (*Rana clamitans*) tadpole or with a palatable eastern gray treefrog tadpole (*Hyla versicolor*) and placing them into a tank containing one green sunfish *Lepomis cyanellus*. The first tadpole consumed was recorded. We quantified anti-predator behavior in eight 38 Liter (10-gallon) aquaria containing ten *A. crepitans* tadpoles and a refuge consisting of a glass Petri dish and rubber stoppers. Four of the aquaria were randomly designated experimental tanks and received a daily treatment of water containing fish chemicals. Three times of day, the number of tadpoles in the refuge and the number of tadpole movements in a one minute period was measured. The *L. cyanellus* did not have a preference for the green frog or the eastern gray treefrog tadpoles in relation to the cricket frog tadpoles ($\chi^2$ = 0.026, d.f. = 1, p = 0.873; $\chi^2$ = 0.0476, d.f. = 1, p = 0.493). Tadpoles had significantly different movement rates in the control and experimental tanks as well as at different times of day (H = 55.186, d.f. = 5, p = 0.000). Our results indicated that cricket frog tadpoles decrease their movement rates in the presence of fish chemicals and are more active at night. These behaviors may reduce fish predation.

**Board 101 EFFICACY OF PESTICIDES TO THE MULTICOLORED ASIAN LADY BEETLE ON GRAPES. R. N. Williams, williams.14@osu.edu, D. S. Fickle, fickle.1@osu.edu, K. B. McClure, mcclure.63@osu.edu, Dept of Entomology, The Ohio State University, 1680 Madison Ave., Wooster OH 44691.**

In 2005 numerous chemicals with insecticidal properties were evaluated in the management of the multicolored Asian lady beetle (MALB), *Harmonia axyridis* (Pallas). In the laboratory, grape slices were soaked in Aza-Direct® (azadirachtin), Prev-Am® (orange oil plus an organic surfactant), and Stealth-NOW® (soybean oil) and then evaluated for their repellant properties. The treated grapes were then placed in 450ml ventilated plastic containers with 10 MALB adults. Untreated grapes were found to be most attractive and were used as a standard control. Repellency was measured by the number of MALB avoiding the treated grape slices as compared to the control. Aza-Direct® was the most repellant, sub-lethal product tested. Prev-Am® and Stealth-NOW® were less repellant than Aza-Direct®. The insecticides Provado® (imidacloprid), a neonicotinoid, Venom® (dinotefuran), a 3rd generation neonicotinoid and Evergreen® (piperonyl butoxide - pyrethrins) a biorational insecticide were evaluated for knockdown and mortality in the same bioassay technique as previously described. Provado® demonstrated immediate knockdown of MALB on contact, with >60% recovery of MALB after initial exposure. Two new products, Venom® and Evergreen® performed well in the laboratory bioassays and beetle recovery was <60% so they were subsequently field tested. Aza-Direct®, Venom® and Evergreen® were applied to grapes in the field and their affect on MALB numbers was measured. The action of all products mirrored laboratory results.

**Board 102 INSECT PEST MANAGEMENT WITH TREATED BANANA BAGS. R. N. Williams, williams.14@osu.edu, E. Alvarado, ealvarad@earth.ac.cr, L. Quiros, lquiros@earth.ac.cr, A. Martinuz, amartinuz@earth.ac.cr, R. de la Cruz, rdlacruz@earth.ac.cr, M. Ellis, ellis.7@osu.edu, K. B. McClure, mcclure.63@osu.edu, The Ohio State University, 1680 Madison Ave., Wooster OH 44691.**

Plastic banana bags treated with chlorpyrifos, a combination of mustard and capsicum or untreated bags were evaluated for efficacy in the control of the western flower thrips, *Frankliniella occidentalis* (Pergande). In this laboratory experiment, 10 adult thrips were placed in unventilated, 50 x 9 mm covered Petri dishes. A treatment replicate consisted of a disk the size of the Petri dish cut from the plastic bag and placed inside the Petri dish. Treatments were replicated 4 times. Clear untreated plastic bag disks were employed as the untreated control. Readings were taken for the number of dead, moribund, or live insects after a 24-hour exposure. Chlorpyrifos treated banana bags killed 100% of the thrips in 24 hours while the mustard/capsicum treated bags only killed 60% of the thrips in 24 hours. In the control 50% of the thrips were dead in 24 hours. This experiment shows that the chlorpyrifos treated banana bags are very effective in killing thrips when they are kept in close proximity to the bags for a 24 hour period while the alternative mustard/capsicum treated bags were not significantly different from the control over the same time period. Significance in these trials was determined by LSD test (P=0.05).

**Board 106 EVALUATION OF ALTERNATIVE PESTICIDES TO CONTROL *Stryman basilides* (LEPIDOPTERA: LYCAENIDAE) IN PINEAPPLE FIELDS. F. J. Bermúdez, felipe_bermudez@hotmail.com, E. Alvarado, ealvarad@earth.ac.cr, P. Tabora, ptabora@earth.ac.cr, H. Castillo, hcastillo@earth.ac.cr, R. N. Williams, williams.14@osu.edu, M. Ellis ellis.7@osu.edu, EARTH University, Apartado 4442-1000, San José, Costa Rica.**

The use of synthetic pesticides as the only means of disease, weed, and insect pest control on pineapple are under pressure by environmental groups worldwide, particularly in Costa Rica. The pineapple borer, *Strymon basilides*, is a major insect pest of pineapple. Most pineapple producers use synthetic insecticides to control the pineapple borer, with many using only carbaryl on a regular basis. The objective of this study was to assess the effect of non-synthetic biological insecticides on populations of *S. basilides*. Five insecticides were evaluated for efficacy against the pineapple borer at the EARTH University Academic Farm from April to September 2005. Four biological insecticides were compared to carbaryl, a commercial standard; they were *Metarhizium anisopliae*, *Beauveria bassiana*, *Bacillus thuringiensis* var. Kurstaki (Berliner), and Amargo (a quassinoid plant extract of *Quassia amara* L.). An untreated control was included. A random block experimental design with six treatments and six repetitions was used. *Bacillus thuringiensis* and carbaryl were found to be the best at controlling the pineapple borer, with no significant difference (P <0.05; Duncan) between these two treatments. However, *Bacillus thuringiensis* was more economical than carbaryl.

**Board 108 DOES ANTENNULE MORPHOLOGY VARY BETWEEN TWO POPULATIONS OF THE CRAYFISH *CAMBARUS CAVATUS?* Marina Sodagar, sodaga_m@denison.edu, (Kristina S. Mead, meadk@denison.edu), Biology Dept, Denison University, Granville OH 43023.**

Crayfish use their sense of smell to find food, mates, and suitable habitats, to detect predators, and to communicate with others. They sample their chemical environment by flicking their antennules through the surrounding water. Odors are detected by long, slender chemosensory hairs (aesthetascs) located in rows or clusters of one to five on the distal dorsal surface of the lateral antennule filament. The crayfish were collected from the bottom of muddy ponds in the Denison University Biological Reserve (DUBR; n=3) and from shallow ditches found near the intersection of SR-79 and 383 (Schoolhouse, n=6). Animals in these two populations might experience quite different hydrodynamic environments (1-3 meters deep pond with relatively cool water vs. very low water in a warm, stagnant gully). Because the ecologically important odors for this species are waterborne, *C. cavatus* might experience different odor signals and might therefore have different antennule structures in these two habitats. This hypothesis was tested by comparing antennule length and aesthetasc length, diameter, and spacing between the two crayfish populations. Structural parameters were measured using Scion Image software on SEM micrographs. Analyses of variance were performed using StatView. DUBR crayfish had aesthetascs that were longer and inserted at a greater angle than the aesthetascs of the schoolhouse population. The DUBR segment lengths were smaller and the gaps between aesthetascs were smaller than in the schoolhouse population. High speed video indicated that odor sampling movements of the antennules of the two populations were similar and typical of other small crustaceans.

**Board 110 ENVIRONMENTAL EFFECTS ON FROG CALL INTENSITY AND FROG SPECIES DIVERSITY IN CLARK COUNTY, OHIO. Julia M. Murgatroyd, s06.jmurgatroyd@wittenberg.edu, Sean M. Buchan, s06.sbuchan@wittenberg.edu, Rebecca L. Cope, s05.rcope@wittenberg.edu, Kevin Gribbins, kgribbins@wittenberg.edu, Tim Lewis, tlewis@wittenberg.edu, Dept of Biology, Wittenberg University, Springfield OH 45501-0720.**

This study examined the population and species diversity of Ohio frogs in Moorefield Township of Clark County, Ohio. This information has never been recorded for Clark County. In order to get an accurate measurement of the frog population, frog calls were observed at 10 locations between April and May of 2005 between 9 PM and 11 PM. Call intensity verses air temperature and habitat types were analyzed to determine the conditions in which frogs call. Call intensity was measured on a scale from 0 to 3, with 0 being no frogs calling and 3 being a continuous chorus. Only 4 of the 11 species of Ohio frogs were heard calling during the course of this study: Cope's Gray Treefrog (*Hyla chrysoscelis*), Green Frog (*Rana clamitans*), Spring Peeper (*Pseudacris crucifer*), and Bullfrog (*Rana catesbeiana*). A direct positive relationship was found between

frog calling intensity and warmer air temperatures. Frog call intensity analyzed at different habitats showed that the four species heard have preferred calling habitats. A specific study of the Spring Peeper was also done during April 2005 to determine the relationship of air temperature, barometric pressure, relative humidity, and dew point to call intensity. The null hypothesis was no relationship between the variables and call intensity. A regression plot of the variables was performed and significant relationships were found between call intensity, air temperature (P=0.071), and humidity (P=0.060). The correlation between air temperature and call intensity was positive and the correlation of call intensity versus humidity was negatively correlated.

**Board 112 EFFECTS OF HONEYSUCKLE, *LONICERA* SPP., PHENOLOGY ON AVIAN NEST PREDATION. Lauren E. Hitchcock, hitchcock.204@osu.edu, (Amanda D. Rodewald, rodewald.1@osu.edu), School of Environment and Natural Resources, The Ohio State University, 2021 Coffey Rd., Columbus OH 43210.**

Exotic plants are recognized as serious threats to biodiversity due to the tendency to disrupt ecosystem processes and alter floristic composition. Recent work also shows that exotic plants can influence predator-prey interactions. For example, birds nesting in exotic shrubs, such as *Lonicera maackii* in urbanized areas, are more likely to have their nests depredated than if they nested in native substrates. However, no studies have evaluated whether or not this increased vulnerability to predation varies temporally. Increased predation is especially likely given that *Lonicera* shows advanced leaf phenology and often exhibits full leaf flush long before other nesting substrates are available to breeding birds. In this study, we explicitly (1) examine how vulnerability to nest predation changes throughout the nesting season for native and exotic substrates and (2) identify the period during which risk of depredation in *Lonicera* is greatest. Our hypothesis is the risk of nest depredation in *Lonicera* is greatest early in the breeding season when *Lonicera* is one of the only plants with leaf flush. Working in 12 stands of mature riparian forest in central Ohio, from 2003-2005, >500 nests of understory-nesting birds, such as Northern Cardinal, *Cardinalis cardinalis*, were found and monitored until their fate was determined. Probabilities of nest survival in native and exotic substrates will be calculated separately for each year. Relationships between nest survival and julian date will be examined using regression analysis. Studying the underlying relationship between nesting substrate phenology and predation allows for a deeper understanding of the impact of exotic shrubs on ecosystems.

**Board 114 THE EFFECT OF NEONICITINOIDS ON THE MULTICOLORED ASIAN LADY BEETLE IN GRAPES. D. J. Inclan, dinclan@earth.ac.cr, R. N. Williams, williams.14@osu.edu, M.A. Ellis, ellis.7@osu.edu, D. S. Fickle, fickle.1@osu.edu, and K. B. McClure, mcclure.63@osu.edu, 1680 Madison Ave., Dept of Entomology, The Ohio State University, Wooster OH 44691.**

The presence of the Multicolored Asian Lady Beetle (MALB), *Harmonia axyridis* (Pallas), in grape clusters at harvest has become an important problem for wine production in eastern North America. A powerful defensive chemical emitted by the MALB when disturbed is responsible for causing a sensory defect in wine. The tainting of the wine is caused by the presence of the beetles within the grape clusters at grape crush. The purpose of this study was to evaluate two neonicitinoid pesticides ProvadoÒ (imidacloprid) and VenomÒ (dinotefuran) for possible control of MALB at harvest. These trials included an untreated control for comparison. Beetles were exposed in bioassays to ProvadoÒ and VenomÒ treated grape slices in ventilated plastic containers. Each treatment was replicated 4 times using 10 beetles per replicate. Beetles were removed from the treated grapes at the end of 24 hours and were held for an additional 48 hours in a clean container. Results demonstrated similarity in knockdown for the two pesticides in the first 24 hours, but at the 72 hour reading VenomÒ was statistically superior to ProvadoÒ (Duncan P£0.05). The principal difference with these insecticides was that 50% of the beetles knocked down by ProvadoÒ recovered while with VenomÒ only 15% recovered. This work demonstrated that ProvadoÒ and VenomÒ are options to control the MALB, because they both have knockdown capability. The principal difference is that ProvadoÒ allows more beetles to recover and has a shorter pre-harvest interval (PHI), 0-days whereas, VenomÒ has a 1-day PHI.

**Board 116 DOES FIELD ODOR TRACKING PERFORMANCE IN THE CRAYFISH *CAMBARUS ROBUSTUS* VARY WITH TIME OF DAY? Mark Laughlin, laughl_m@denison.edu, (Kristina S. Mead, meadk@denison.edu), Biology Dept, Denison University, Granville OH 43023.**

Crayfish, like many aquatic crustaceans, relay on their sense of smell to find food, mates, and suitable habitat, to detect predators, and to communicate with other individuals. This ability is primarily dependent on sense of smell, but the effects of time of day are mostly unknown. Visual cues that might assist in odor tracking along with daily cycles are affected by time of day and could have an effect on odor tracking ability. To test this hypothesis, twenty-five crayfish (specifically *Cambarus robustus*, chosen due to abundance) were marked with reflective tape and filmed while tracking odors at different times of day in Raccoon Creek located in Licking County, Ohio. Times of day for the tests were standardized by the sunrise/sunset times posted by the US Naval Observatory for Granville, Ohio in order to take seasonal changes into account. Concurrent flow and measurements were made using a propeller-type flow meter. Water depth and temperature also were recorded. Video will be analyzed using Image J software and analyses of variance comparing odor tracking success, time needed to find the odor cue, and path curvature will be performed using StatView. Although crayfish are generally described as crepuscular, preliminary results indicate that *Cambarus robustus* was most active at night but was most successful in its searches in the morning.

**Board 118 STRUCTURAL AND FUNTIONAL FEATURES OF ANTENNULE REGENERATION IN THE CRAYFISH *ORCONECTES SANBORNII*. Julianne R. McCall, mccall_j@denison.edu, (Kristina S. Mead, meadk@denison.edu), Denison University, Slayter Box 1678, Granville OH 43023.**

Crayfish are capable of regenerating sensory structures such as their antennules. These olfactory appendages allow the organisms to receive stimuli from the environment such as information directing them toward food or mates. The ability to regenerate nerve systems is an advantage in an environment where damage from fights, infection, and distress is common. The hypotheses of this study are that 1) the pattern and speed of regeneration will be relevant to the size of the individual and 2) the regenerating antennule will appear anatomically identical to the undisturbed antennule, with the exception of right/left symmetry. One local species, *Orconectes sanbornii* (N=48), was collected and antennulectomized to initiate the regenerating process. A new method of analysis was developed and applied to avoid destructive sampling of antennules and provide *in vivo* data. Using Spurr's epoxy resin, progressive molds of the regenerating antennules were collected and analyzed via a scanning electron microscope prior to and during the stages of regeneration. This nondestructive method allows several progressive samples of the same individual to be collected- a clear advantage in comparing continuously-regenerating tissues. Throughout the stages of regeneration, intermolt crayfish will be tested in a Y-maze method to assess their ability and speed in tracking odors. Utilizing both methods, a relationship will be established between structural regeneration of the antennules and the resulting changes in olfactory ability.

# Pre-College Posters – Session C 3:30 – 5:00 PM

**Board 120 IS THE MOST EXPENSIVE BAG BEST? Christina M. Daly, christina_daly07@yahoo. com, 765 West Township Road 1190, Tiffin OH 44883. (Tiffin Columbian High School)**

This experiment explores whether the most expensive brand of 13 gallon tall kitchen trash bags is best and if so, why. The best brand would be the most cost effective and has the best scores for physical characteristics of break weight, elongation, and tensile strength. The hypothesis is that the most expensive brand, Glad Force Flex®, will have the best scores on the tests because a thicker, better quality material was used in its production. For this experiment one sample was hung between two rods suspended in a doorway with a bucket attached to the lower rod and water was added until the sample snaps; in fact, there were five samples from each of the four brands and sample size was 14 inches by 1.5 inches. The data from these tests showed that Ruffles® is the most cost effective brand, because it is the cheapest and has the highest tensile strength. The most expensive brand, Glad Force Flex®, does not offer any significant improvements over the other brands for its increased price. These results indicate that price is not a good indicator of brand quality; tensile strength is a more effective indicator. Also, bag thickness is not as important as the quality of production material because the thickest brand did not have the highest test scores. However, only the thickness and price are available to consumers so they can only go by trial and error to

determine which brand of 13 gallon tall kitchen trash bags is the best. If trial and error is used, then the results of this study show that the cheap and thin brands are worth trying.

**Board 121 DOES THE INUNDATION OF A TSUNAMI WAVE DEPEND UPON THE DEPTH OF THE OCEAN? Lali J. Reddy, lollipop603@aol.com, 504 Greenbrier Court, Steubenville OH 43952. (Catholic Central High School)**

A tsunami is a phenomenon in which a series of traveling ocean waves with long wavelengths and long periods are generated by an earthquake below or near the ocean floor. Such an earthquake causes a vertical displacement of the water. Inundation is a term that is used to describe the amount of water that goes onto the land. The purpose of this project is to determine if the inundation of a tsunami wave is dependent upon the depth of the ocean. The hypothesis of this study is that the inundation of a tsunami wave is dependent upon the depth of the ocean. In this study, a model of a beach was created in a round, white tub by using pea gravel, marble rocks, and sand. The rocks were place obliquely in the tub and the tub was filled with the required amounts of water. Prior to filling the tub with the rocks and sand, the tub was marked by centimeters and half centimeters. This indicated the amount of water that the tub was filled with. The range, in half centimeters, of the depths was 5-19 cm. Twenty-nine experiments were done for each of the three trials. A tsunami was generated by using toilet suction. A wooden skewer was placed in the water to indicate the water level. A second wooden skewer was placed at the farthest point the waves reached. A ruler was used to measure the distance between the two skewers, the inundation. At 19 cm of ocean depth, the inundation was 2.3 cm. At 5 cm of ocean depth, the inundation was 4.7 cm. The data that was collected was the ocean depth, the beach water level before the tsunami, the beach water level after the tsunami, and the inundation. Based on the collected data, decreasing the ocean depths generated larger inundations. In conclusion, the hypothesis of this study was proven to be correct. The results of this study show that tsunamis are more likely to occur in more shallow water than in deeper water.

**Board 122 DISTRIBUTED DATA BACKUP OVER A PEER NETWORK. Zachary J. Tong, zachary@tong-web.com, 6171 Mere Drive, Mason OH 45040. (William Mason High School)**

This project was created to solve the problem of safely and securely backing up critical data. The project allows users to backup critical data to a distributed network of peers and retrieve the data if their personal computers should fail. Backed up data is stored on others' hard drives, and peers are forced to share a percentage of their available hard drive space on the network. Mathematically, there is not enough space being shared on the network to provide for the users. Statistically, however, most users will never upload as much data as they are forced to share. For users to trust the network with their critical files, the network must be secure. All communications are initiated using an asymmetric encryption handshake. The asymmetric encryption is used to pass a symmetric encryption key, which is used for all further communication. The data being backed up is encoded using a forward error encoding method known as Reed-Solomon encoding. This breaks a file into six pieces that can then be distributed to six different peers. Once distributed, only three of the six pieces are needed to fully recreate the original file. Furthermore, the file encoding makes it impossible to recover the original file without two other pieces. Data backed up to the network is not readable by anyone except the originating peer. The result of the project was a fully operable distributed data backup system that could store and retrieve data on network of peers in a safe and secure manner.

**Board 123 THE EFFECTS OF ACIDS AND BASES ON THE BROWNING OF APPLES. Amy Y. Omar, frenchchik09@netscape.net, 4700 Barnsleigh Dr., Akron OH 44333. (Our Lady of the Elms High School)**

The purpose of this study is to observe the effects of acids and bases on the rate of browning of apples after they are cut and the enzymes within are exposed to oxygen. The hypothesis is that if acid is added to the surface of an apple, then the rate of the enzymatic browning reaction of the cut apples will decrease. Gala Apple slices were placed into separate cups, and exactly 100 mL of solutions were added to each labeled cup. The solutions were two acids; lemon juice, vinegar one neutral; water and two bases; milk of magnesia and baking soda water solution. The control group was an apple with no substances. The Ph levels of all the solutions were measured, in order to compare the results of the apples immersed in more acidic/ basic solutions. The appearance of each apple was recorded immediately after placing them in the substances, and the slices were set aside for one day at room temperature. The apple slices were observed again the next day and changes in color, texture, and scent were recorded. Based on the observations from this study, the apple slice(s) treated with lemon juice were observed to be the least changed. The apple slice looked and felt exactly the same as before. The apple slice treated with vinegar exhibited the most change. After 60 minutes, the apple slice treated with vinegar turned dark brown. The observations from this study show that substances with lower Ph levels reduce the amount of oxygen available to enzymes and decrease the rate of browning.

**Board 124 THE EFFECTS OF VARIOUS ENVIRONMENTAL FACTORS ON THE CONCENTRATION OF DISSOLVED OXYGEN IN THE BLANCHARD RIVER, PUTNAM COUNTY, OH AND ITS TRIBUTARIES, PIKE RUN AND CRANBERRY CREEK. Megan E. Schroeder, 7schrme@mail.ml.noacsc.org, 8744 State Route 613, Leipsic OH 45856. (Miller City High School)**

Aquatic organisms, such as fish, depend on dissolved oxygen for survival, along with ecosystems and natural water resources. The purpose of this study is to determine how the concentration of dissolved oxygen in the Blanchard River, Pike Run, and Cranberry Creek is affected by changes in the environmental factors of turbidity, water turbulence, water temperature, and barometric pressure. The hypothesis is that turbidity, water turbulence, water temperature, and barometric pressure will have an indirect relationship with dissolved oxygen concentration. Field-testing for water sample collection utilized dissolved oxygen titration kits, barometers, thermometers, sediment sticks, and stopwatches. Turbidity was determined using a sediment stick. Water turbulence was determined by measuring the rate of movement of walnuts in the water with a stopwatch. As samples were collected, water temperature and barometric pressure were measured. The concentration of dissolved oxygen was determined by using a titration kit. The hypotheses for turbidity, water temperature, and water turbulence were supported by the results of this study, while the hypothesis for barometric pressure was not supported. Analyses of all stream data indicate an indirect relationship between water temperature, water turbulence, turbidity, and oxygen concentration with $R^2$ values of 0.403, 0.045, and 0.144, respectively. Analyses also indicate that the average indirect relationship between the variables had slopes of -0.044, -0.081, and -0.405, respectively. Water turbulence in Cranberry Creek had an $R^2$ value of 0.958, indicating a strong correlation between oxygen concentration and water turbulence. Turbidity and oxygen concentration were found to be indirectly related with an $R^2$ value of 0.787 in the Blanchard River, showing a strong correlation between turbidity and oxygen concentration. The results of this study help to determine the cause of fish kills due to dissolved oxygen concentrations.

**Board 125 WHICH ROOM IN THE HOUSE IS THE MOST CONTAMINATED WITH BACTERIA? Raymond Tan, ztan@cinci.rr.com, 8308 Cherrydale Ct., Mason OH 45040. (Mason High School)**

A simple microbiological method was developed to quantify the air-borne bacteria in different parts of a household, including the bathroom, the bedroom, and the kitchen. It is hypothesized that the bathroom is the most contaminated with bacteria. The investigation was conducted by putting agar plates into each room of the house and exposing the opened plates to the air for eight hours before covering the plates and allowing the bacteria to grow at room temperature. Unopened agar plates that were never exposed to the air were also placed in each room as controls. The bacterial growth on the agar plates over time was recorded with a home digital camera, and quantified by counting the number of bacterial colonies in each plate. Observations of the bacterial colonies were made with a digital stereo microscope. Images of bacteria were also taken with a Zeiss high magnification light microscope. It was found with 95% level of confidence by t-statistics that the bathroom had the largest amount of bacteria. The kitchen had the second largest bacterial counts, and the bedroom consistently had the lowest level of bacterial counts. This method may be used for monitoring hygienic and sanitary conditions in homes or offices. It might also be further developed into a screening tool for disease or germ control.

**Board 126 CELESTIAL NAVIGATION VS. GPS NAVIGATION. Yu Lin Lin Huang, linlin16relena@hotmail.com, 282 Maple Ave., PO Box 53166, Pettisville OH 43553. (Pettisville High School)**

Celestial navigation is navigation by stars, while GPS navigation is the use of satellites in geosynchronous orbits around the earth

to position the location of the observer. The objective of this investigation was to compare the navigational systems' accuracy to determine latitude and longitude of the observer. The hypothesis was celestial navigation would be more accurate than GPS. A gnomon-stand was placed on a flat, large poster board at an airport around noon on a clear, sunny day. Record the shadow of the gnomon's length on the poster every minute over the course of 2 hours. Mathematics was used to decipher the altitude of the sun and local noon. The formulas are altitude of sun: tan (altitude) = (length of gnomon) / (length of shadow), and true noon= (local noon) – (EOT correction) – (daylight savings). The observer's latitude and longitude was determined: longitude= 75º + (true noon – 12:00)/4 and latitude= 90º- $a_{max}$ + declination of sun. Airport coordinates were taken using a GPS receiver. Both navigational system results were compared with the known airport coordinates. Differences to airport coordinates were calculated: (airport coordinate) – (celestial navigation or GPS coordinates) latitude and longitude respectively, and $(difference)^2 = (latitude)^2 + (longitude)^2$. Five trials were conducted at five different airports. (Williams Co. OH, Fulton Co. OH, Toledo Express, OH, Defiance Co. OH, and Fort Wayne International, IN) The data from this study proved the hypothesis false. Celestial navigation has an average error of 255.26 miles, and GPS navigation, 1.34 miles off of the airport coordinates.

**Board 127 THE EFFECT OF SURFACTANTS ON PLANT GROWTH. Wil Kamps, Rustyreign@sbcglobal.net, 9761 Sunrise Blvd., North Royalton OH 44133. (Cuyahoga Valley Career Center, Dept of Horticulture)**

Bean plants (*Phaseolus vulgaris*) were tested to determine the effect of different amounts of a wetting agent on growth. A surfactant (wetting agent) is a substance that reduces surface tension between two substances. Surfactants are used in greenhouse applications to increase the penetration of water into soil. The surfactant tested in this experiment was Soax™, manufactured by Smithers-Oasis. Plants were treated with the recommended amount of Soax™, four times the recommended amount, and tap water. The plants treated with the recommended amount of Soax™ were predicted to have better overall growth compared to plants that had no Soax™ application and plants treated with four times the recommended amount. The experiment was conducted in a controlled greenhouse environment. Bean plants (Blue Lake variety) were used as the test plant. Three flats of fifteen pots were placed in the greenhouse at the beginning of the experiment. The bean plants were sown at a depth of 0.5 cm. The plants were watered every two days on average, using an injector proportioned to one unit of Soax™ to one hundred units of water. The first flat was treated with tap water, the second flat was treated with the recommended amount (1x) of Soax™ (15.4 oz per gallon), and the third flat was treated with four times the recommended amount (4x) of Soax™ (62.0 oz per gallon). The plants received equal volumes of treatments. At the conclusion of the experiment, the measurements of each plant were recorded and analyzed statistically. The mean heights for each trial were: 18.8 cm (tap water), 19.7 cm (Soax™ 1X), and 15.1 cm (Soax™ 4X). A t-test was used to analyze the results of the experiment. The difference between mean heights of Soax™ 1X and Soax™ 4X was statistically significant ($p < .005$). Two possible reasons for diminished growth of the 4X treatment were: (1) the wetting agent may have caused the water and the dissolved nutrients to leech through the soil too quickly (2) the excess surfactant may have decreased the waters ability to dissolve nutrients needed for optimum growth. A t-test was used to analyze the difference in means between the 1X plants and tap water plants ($p = 0.57$). It was likely that the non-significant difference in the height of the 1X and tap water treated plants was due to the plants being in containers.

**Board 128 THE EFFECTS OF REGULAR STRETCHING OF THE INNER AND POSTERIOR THIGH MUSCLES. Brittany A. Sheehan, mikeandsuesheehan@hotmail.com, 10069 Phillips Rd., Bluffton OH 45817. (Bluffton High School)**

The purpose of this experiment was to determine if significant gains in flexibility could be achieved in the inner and posterior thigh muscles of middle school students by adding 5-10 minutes of stretching exercises to daily physical education (P.E.) class. The hypotheses is that regular stretching of the inner and posterior thigh muscles will result in a significant increase in flexibility in middle school students. A physical therapist designed a stretching program for the adductor and hamstring muscles. A measuring device was developed to measure finger reach in long sitting. The device also recorded heel to heel inner thigh flexibility measurements and served as a record for all data collected on each student. The P.E. class was randomly divided into two groups of 13 middle school students, with one group of thirteen students serving as the control group and the other group of thirteen students serving as the test group. Initial measurements were taken of the flexibility of the inner thigh muscles (adductors) and posterior thigh muscles (hamstrings). The test group was instructed in the stretching program which was carried out five days/week, during the first 10 minutes of P.E. class, for 4 weeks. Measurements were repeated after the completion of the 4 weeks of exercise. Review and analysis of the data revealed that test group participants demonstrated overall average flexibility gains that were 70.6% greater than that of the control group. The hamstring flexibility gains in the boys were 74.7% greater and in the girls were 80.7% greater, in the test versus control groups. The adductor gains in the boys were 65.3% greater and in the girls were 64.2% greater, in the test versus control groups. These results show that significant gains in flexibility can be achieved by adding small amounts of regular stretching to P.E. classes.

**Board 129 HOW MICRO-WAVING SEEDS AFFECTS THEIR GERMINATION. William N. Copes, b1boma@aol.com, 3144 Imperial Blvd., Springfield OH 45503. (Rockway Middle School)**

The purpose of this study was to see how micro-waving radish seeds (raphanus sativus) would affect their germination, growth and overall health. The hypothesis was that the resulting germinated seedlings from the seeds that were micro-waved the longest would germinate the quickest, and that the resulting seedlings would also be less healthy than the non-micro-waved seedlings. In the study, 5 different groups of 10 radish seeds were micro-waved for different lengths of time. The first group of 10 radish seeds was micro-waved for 10 seconds, the second group for 20 seconds, the third group for 40 seconds, the fourth group for 60 seconds, and the fifth group for 120 seconds. One group of 10 seeds was not micro-waved, and served as a control. Each of the groups was enclosed in a wet paper towel, and placed in its own germination chamber, constructed from glass plates, and plastic wrap. The groups of seeds were watered with 1 ML of water every other day to keep them moist, and placed in the same window. The seeds were observed for a period of 6 days. The resulting seedlings were measured daily using a MM scaled ruler, and size, color and general appearance was charted for the six days of the study. The color and texture of the resulting seedlings were compared to the control group of non-micro-waved seedlings. Based on these criteria, the following conclusion can be drawn: the greater the length of micro-wave time, the less healthy the resulting seedlings.

**Board 130 THE FADING OF CLOTHING. Sarah F. Perrine, sunflowergirl@nktelco.net, 09144 Center Rd., New Knoxville OH 45871. (New Knoxville Local School)**

The fading of clothing is of interest to all areas of the textiles industry. Eighteen main ingredients make up detergent and contribute to the cleaning of clothes. The purpose of this study was to investigate why clothes fade and to determine which of five detergents best prevented the fading of clothes. The hypothesis was that Cheer® will work the best because it is made specifically for the protection of color. In this experiment the following materials were used: five detergents and two shirts (red and black, both 100% cotton). Both shirts were cut into six pieces and one piece of each shirt was designated as the control. Five bowls were filled with three quarts of water at 118° and a teaspoon of detergent was added to each bowl. This is proportionate to the amount of water and detergent used in an average washer. A piece of cloth was placed into each bowl and stirred for fifteen minutes. The suds and color of the water were observed after each wash, and the cloths were rinsed in cold water and dried in the open air. This procedure was repeated ten times for each cloth. The color change was obvious when the cloths were compared to the control piece. All Free and Clear® had the least amount of suds, and also reduced the amount of fading, followed by Tide®, Cheer®, Purex®, and Era®. The results of this study may be of importance to detergent manufacturers, consumers, and others in the textiles industry.

**Board 131 IS CARBON DIOXIDE ($CO_2$) ANOTHER CAUSE OF GLOBAL WARMING? Elif I. Kuguoglu, elifkuguoglu@yahoo.com, 794 Boulevard St., Akron OH 44311. (Miller South School for the Visual and Performing Arts)**

Man-made emissions of greenhouse gases have increased, largely as a result of the burning of fossil-fuels and deforestation. The carbon dioxide coming from your car goes up in to the atmosphere. Then infra-red photons coming from cooled objects on Earth make their way up into the atmosphere and bounce off of the carbon dioxide molecules. The infra-red photons then come back to the Earth and warm the Earth. Over the past century, the average global temperature has increased by 0.6 degrees centigrade, the

largest for the northern hemisphere. The purpose of this study was to show that carbon dioxide is a greenhouse gas, and to identify which type of car releases the most amount of carbon dioxide. The first hypothesis of this study was that if a jar was filled with air and another was filled with carbon dioxide, then the jar filled with $CO_2$ would have a warmer temperature. The second hypothesis was that if samples of exhaust were collected from an old car (1990 Volkswagen Jetta), a new car (2005 Honda), and a hybrid car (2005 Honda Hybrid); then the old car would emit the most carbon dioxide. In the first part of the study, one jar was filled with pure carbon dioxide, and the other was filled with air. Both jars were securely covered with plastic and a rubber band. The jars were placed under a light, and the temperature of each jar was measured every 20 minutes for 3 hours. In the end of the experiment the outcome was that the greatest difference of temperature was 4° F where the jar filled with carbon dioxide was warmer. The results from this study showed that the jar with carbon dioxide had a higher temperature, indicating that carbon dioxide may contribute to global warming. In the second part of the study, the exhaust from an old car (1990 Volkswagen Jetta), a new car (2005 Honda), and a hybrid car (2005 Honda Hybrid) were collected and bubbled into BTB solution (carbon dioxide indicator or bromothymol blue) to determine the concentration of carbon dioxide emitted by each car. The results from this study showed that the 2005 Honda Hybrid car emitted more carbon dioxide than the new 2005 Honda and the old 1990 Volkswagen Jetta. Because hybrid cars do not use electricity as a power source until drivers reach a particular speed, this study reveals that the cars may still contribute to global warming.

**Board 132 PVDF/POLY(AMPS-CO-EGDM) PROTON CONDUCTING MEMBRANES FOR DIRECT METHANOL FUEL CELLS. Claire Pavlak[1], swim601@cox.net, Ryszard J. Wycisk[2], rjw19@case.edu, Jun Lin[2], jxl109@case.edu, Peter N. Pintauro[2], pnp3@po.cwru.edu[2], [1]Hathaway Brown School, 19600 North Park Boulevard, Shaker Heights OH 44122, [2]Dept of Chemical Engineering, Case Western Reserve University, 10900 Euclid Avenue, Cleveland OH 44106-7217.**

A direct methanol fuel cell (DMFC), viewed by many as the power source of the future for portable electronics, creates electricity through the electrochemical oxidation of methanol. A proton conducting membrane is at the heart of the DMFC and serves as the separator of the fuel and the oxidant while allowing for the passage of protons. Commercially available membranes like DuPont's Nafion® are very expensive and leak significant amounts of methanol during fuel cell operation. The present study aims to develop a new, cost effective membrane with superior methanol barrier properties based on a poly(vinylidene fluoride) (PVDF) scaffold and crosslinked poly(acrylamidosulfonic acid). The membrane is prepared by first dissolving PVDF (Kynar 741), 2-acrylamido-2-methyl-1-propanesulfonic acids (AMPS), ethylene glycol dimethacrylate (EGDM), 2,2-dimethoxy-2-phenyl-acethophenone and benzoyl peroxide in dimethylacetamide solvent. Next the solution is cast into a thin film and irradiated with UV light. After solvent evaporation at 80°C, a thin membrane is formed. A series of membranes have been obtained through variation of the polymer-monomer-initiator composition and changes in irradiation/evaporation conditions. With increased loading of poly(AMPS-co-EGDM), the proton conductivity of the membranes (equilibrated in water at 25°C) increased from 0.01 to 0.06 S/cm. Methanol permeability measured at 60ºC was in the range $4{\cdot}10^{-8}$ to $1{\cdot}10^{-6}$ $cm^2/s$ and was 5-120 times smaller than that of Nafion® ($5{\cdot}10^{-6}$ $cm^2/s$). DMFC performance of selected membranes was superior to that of commercial Nafion® 117 and significantly lower methanol crossover was observed. Future research will be directed towards optimization of the conductivity-permeability membrane characteristics and fuel cell performance.

**Board 133 HOW TO TRAIN A PLANARIAN: THE LEARNING BEHAVIORS AND REGENERATION OF PLANARIA (*DUGESIA TIGRINA*). Jennifer G. Haag, jennyg907@sbcglobal.net, 2319 Lalemant Rd., University Hts. OH 44118. (Beaumont School)**

This investigation, utilizing planaria (*Dugesia tigrinia*), simple, free-living, freshwater invertebrates with the ability to regenerate, measured responses to various stimuli. The question being studied concerns the possibility that these learned responses can be passed to regenerated offspring. My hypotheses were that planaria can master a two-choice training maze; can conditioned to react to colored light, food, and an electric shock; and can transfer the memory of the training from one individual to another through regeneration. Planaria Train-A-Tray™, a two-choice training maze, was used in the study. In the control subgroup, the directions in which 25 planaria traveled were recorded ten times, and the planaria were bisected, allowed to regenerate, and retested. The results were random and not predictable. In the second subgroup, a piece of beef liver was placed in the right arm of the maze and the directions of ten planaria were recorded ten times. The planaria traveled right 80% of the time. After these planaria were bisected and retested, it was determined that the learned information had been passed on because 81% of the offspring traveled right. In the third subgroup, light from a flashlight was shone through gray, yellow, and green light over the right arm of the maze. With the gray light, which was used as the control, five planaria traveled left 82% of the time; with the yellow light, five different planaria traveled left 82% of the time; and with the green light, five different planaria traveled left 80% of the time. It was determined that the planaria were sensitive to the yellow and green light. The part of the experiment in which 20 planaria were exposed to an electric shock yielded no conclusive results.

**Board 134 THE EFFECT OF ULTRA TENSILE WIRE AND FIBERGLASS REINFORCEMENT WITH PLASTIC IN COMPOSITE PRESSURE VESSELS FOR IMPROVING THE HYDROGEN FUEL STORAGE IN AUTOMOBILES. Aakrit Prasad, aakritprasad100@hotmail.com, 4825 New England Lane, Apt. 34, Sylvania OH 43560. (Sylvania Southview High School)**

The recent development of zero emission hydrogen fuel automobiles has put forth a challenge for storing high pressure hydrogen in light weight, impact resistant pressure vessels. Ultra Tensile, 3500-4000 MPa, steel wire was initially developed for light, weight high performance automobile tires. In a previous study Ultra Tensile 3500 MPa (450000 PSI) wire net reinforced plastic matrix composite was examined, and the strength of 145 MPa (21000 PSI) and very high notch Izod toughness was determined. Current carbon fiber wrapped pressure vessel tanks have poor Izod toughness, which is related to damage tolerance. The Current study involved producing and testing a flat plate of composite having a mixture of Ultra Tensile wire net and G-glass fabric (fiberglass E grade) in an epoxy matrix. The Pressure Vessel Equation was used to calculate the strength of the sample, had it been a cylindrical pressure vessel. It was hypothesized that the light weight fiberglass, and the high strength Ultra Tensile wire would compare well to the carbon fiber pressure vessels. Results showed the strength of composite to be 545 MPa (79000 PSI) Tensile strength and at a 32 ft-lb/inch Izod notch strength, which compared well to the carbon fiber reinforced composites. Also, based on the Izod number, the sample had much more damage resistance and was cheaper to fabricate than carbon fiber. A total of ten trials were performed for this experiment. Standard Deviation showed a 2.45% deviation from the mean value. Results supported the hypothesis that Ultra Tensile wire reinforcement to plastic did provide a strong enough composite pressure vessel in fracture toughness to improve the hydrogen fuel storage in automobiles.

**Board 135 FACTORS CONSTRAINING PRIMARY PRODUCTION IN LAKE SUPERIOR. Edward B. Ricard, sricard@woh.rr.com, 502 W. Wooster St., Bowling Green OH 43402. (Bowling Green High School)**

The purpose of this experiment was to determine what combination of nutrients in freshwater samples would produce maximal increases in biomass. The eventual decrease in dissolved oxygen that occurs, as a result, can have dramatic effects on the aquatic organisms in the ecosystem. Surface water from oligotrophic Lake Superior was drawn on September 20, 2004 from the pelagic western arm (Station WM; 47° 20.00', 89° 48.00'). Samples (250 mL) were treated with 22 µM P (as phosphate) and 30 µM N (as nitrate) both individually and in concert. The initial limiting nutrient in freshwater is phosphorus. Nitrogen is believed to be a secondary limiting nutrient to phosphorus. It was hypothesized that samples with both nutrients present, due to the limiting nutrient interactions between phosphorus and nitrogen, would yield the largest amount of chlorophyll, resulting in the largest eventual decrease in dissolved oxygen. All samples were assessed bi-weekly over eight weeks, for the concentration of chlorophyll (µg/L), dissolved oxygen (mg/L), and bacteria, which were microscopically counted. The results showed that no samples experienced significant increases in the amount of chlorophyll or decreases in the amount of dissolved oxygen. These results suggest that light may have had the greatest effect on chlorophyll increase and dissolved oxygen decrease and that nutrient amendment played no significant role in chlorophyll accumulation. A continuation of this experiment using Lake Superior samples obtained during summer 2005 may help to support whether other nutrients may contribute more significantly to chlorophyll accumulation.

**Board 136 PNEUMATIC VALVE OPTIMIZATION BY OPERATION TIME SHORTENING. Alex L.**

**Sterling, alexsterling@alexsterling.com, 259 Woodland Ave., Wadsworth OH 44281. (Wadsworth Senior High School)**

The coaxial pneumatic cannon is popular among recreation pneumatic cannon makers. The term describes the orientation of the exhausting barrel and pressure chamber with the barrel running through the middle of the chamber. The common design utilizes a piston with three sealing locations, the first against the exhaust barrel face, the second against the chamber wall, and the third further back toward the exhaust of the chamber wall. When the piston is sealed against the barrel, there is an air cavity created behind it that is pressurized the same as the pressure as the chamber.. This is exhausted to retract the piston and release the main chamber. The idea being tested is that shortened opening time for the valve directly influences performance. The operation of any valve involves something called dwell time. This is the time it takes from the moment the valve opens until it reaches its fully open state. The design tested in this study replaces the mechanical action of the piston with a new device. The device consists of a rupturing membrane that bursts when the pressure behind it exceeds the strength of the membrane. Such a rupturing device has an extremely short dwell time. A system has been developed that uses two membranes to accomplish firings at precise pressures used to simulate the same stored energy as in the coaxial design. This burst disc membrane system has an average muzzle velocity of 806.6 fps at 100 pounds per square inch (psi) of pressure. This is a significant increase coaxial design whose average muzzle velocity is 776.5 fps at 100 psi.

**Board 137 CAN THE EFFECTS OF ACID RAIN BE REVERSED? Rebecca K. McGrail, jmcgrail@jcc.edu, 366 Westwood Drive, Steubenville OH 49353. (Aquinas Central Catholic)**

The purpose of this study was to determine if the effects of acid rain can be reversed. It was hypothesized that the effects of acid rain can be reversed with a solution of baking soda and rain water because baking soda is a mild alkali and can potentially neutralize acidic soil. Thirty-five garden bean seeds were soaked in distilled water for twenty-four hours. The seeds were planted and grown until they had between six and nine leaves and a decent height. The healthy plants were then divided into three groups: Control, Acid Rain 1, and Acid Rain 2. The Control group was watered with rain water and the Acid Rain groups were watered with a 9% solution of vinegar and rain water. When the plants in the Acid Rain groups exhibited the effects of acid rain (growth was slowed), one group was watered with rain water and the other with a 10% solution of baking soda and rain water to try to reverse the damage caused by acid rain. The procedure was repeated with philodendrons. A total of eight trials were conducted. There were three trial with beans and five trials with philodendrons. The results showed the effects of acid rain could not be reversed in the beans but were reversed in the philodendrons which disproved the hypothesis. In conclusion, acid rain's effects cannot be reversed in all plants.

**Board 138 EFFECTS OF WIRE GAUGE SIZE AND CORE DIAMETER ON ELECTROMAGNETIC STRENGTH. Nathaniel J. Morris, tman1445662002@yahoo.com, 2011 Riverbrook Ct., Dayton OH 45426. (Trotwood-Madison High School)**

The use of an electromagnet is crucial in most magnetic levitation devices. Identifying the factors affecting the strength of an electromagnet would allow for the development of a more efficient way to build a levitating device. Literature and observations suggest electromagnets with the greatest ampere-turns produce the greatest electromagnetic strength. However, observation also suggests as electromagnetic power is distributed over a larger diameter core, the electromagnetic strength decreases. It is hypothesized that electromagnets with the greatest ampere-turns and minimum core diameter would have the greatest electromagnetic strength. Twelve distinct electromagnets were constructed from 4 core diameters (1/4, 3/8, 1/2, and 5/8 inches) and 3 wire gauge sizes (22, 26, and 30 AWG). The length of wire was 20 feet for each electromagnet and 1.5 volts were placed across each electromagnet. The strength of each electromagnet was measured by the number of small nails picked up and by the attraction force, which was measured with a spring scale. Results showed more nails (257 nails +/- 23 nails over 3 trials) were picked up using the 3/8 inch core with the 22 AWG wire. However, the largest attraction force (9.7 N +/- 3.4 N over 5 trials) occurred with the 1/4 inch core with the 22 AWG wire. The results indicate that electromagnet surface area has an effect on the number of items picked up and suggest that there is an optimal relationship between wire gauge size and core diameter on electromagnetic strength.

**Board 139 BUBBLE BUBBLE, BOIL AND TROUBLE: A STUDY OF DEFOAMERS. Laura K. Manson, 07LManso@beaumontschool.org, 2381 Fenwood Road, University Heights OH 44118. (Beaumont School)**

Foam is a common problem in both industry and around the home. Fortunately, there are products available to solve this problem. Defoamers, the name given to such products, are chemicals that prevent foam and destroy foam once it has formed. In general, a defoamer is not soluble in the solution to which it is added, causing the defoamer to form a phase at the surface of the solution. The defoamer then lowers the surface tension of any bubble that forms, thinning the walls of the bubble and causing the bubble to break. Solutions of soy protein, soy flour, egg white, and corn starch in water were used to test the defoamers. Each solute was tested at 12.5 g/L and 25 g/L with seven defoamers: 100 centistoke silicone, 350 centistoke silicone, 100 centistoke silicone, olive oil, soy oil, safflower oil, and peanut oil. Two, four, eight, and twelve drops from a pipette of each defoamer were added to 150 mL of each solution. Aquarium bubble stones connected to an air pump were then placed inside the cylinders with the solutions. The air pump was turned on for 10 seconds, causing foam to form in the solutions. It was hypothesized that the 1000 centistoke defoamer at the greatest concentration would have the greatest effect. The study showed that the oil defoamers, especially soy, were more effective than the silicone defoamers and the concentration of defoamer did not always affect the foam control. It was also determined that the three most important signs of a working defoamer are a complete elimination of foam, an increase in bubble size, and a rapid rate of knock down.

**Board 140 CIRCADIAN RHYTHM REGULATION IN THE PINEAL ORGAN OF ZEBRAFISH. Lauren T. Goldstein-Kral[1], Lgold248@aol.com, Ramil R. Noche[2], ramil.noche@case.edu, Jennifer O. Liang[3], jol@case.edu, [1]3317 Ingleside Road, Shaker Heights OH, 44122, [2]Dept of Biology, Case Western Reserve University, [3]Dept of Biology, Dept of Genetics, Case Western Reserve University. (Hathaway Brown School)**

Melatonin is a hormone that causes diurnal organisms to sleep at regular intervals. The pineal organ in all vertebrates controls the cycle of melatonin biosynthesis, increasing production in the evening and decreasing production in the morning. This cycle in melatonin synthesis is an example of a circadian rhythm, or biological cycle that occurs approximately every twenty-four hours and persists in the absence of environmental cues. The goal of this study is to learn how the circadian cycling of the pineal and melatonin synthesis is controlled in zebrafish (*Danio rerio*). The suprachiasmatic nucleus (SCN) is located in the ventral brain and helps modify the production of melatonin in the mammalian pineal. One hypothesis is that the SCN controls pineal rhythms in zebrafish. To begin testing this hypothesis, circadian rhythms were examined in *cyclops* mutants, which have a normal number of pineal cells, but lack ventral brain, including the region that gives rise to the SCN. Wildtype (n > 10 per time point) and *cyclops* (n=6 per time point) embryos were fixed every four hours for two days. Next, in situ hybridization was performed to stain cells containing mRNA for the circadian gene *serotonin-N-acetyltransferase* (*aanat2*), and the stained pineals were imaged using an Olympus digital camera system. Results showed that *aanat2* in both the wild-type and *cyclops* embryos cycled, but aanat2 in the *cyclops* embryos cycled at lower levels. These results are consistent with the hypothesis that part of the ventral brain, possibly the SCN, modifies *aanat2* rhythms in the zebrafish pineal.

**Board 141 THE PRODUCTION AND PERFORMANCE TESTING OF SMALL BATCHES OF BIO DIESEL FUEL FROM SOYBEAN OIL. Colleen M. Ryan, mjr447@yahoo.com, 202 Church St., Chillicothe OH 45601. (Bishop Flaget School)**

An environmentally friendly fuel called bio diesel can be made from soybean oil using simple methods. Bio diesel does not contain sulfur and has a closed carbon cycle. In the first project phase, three liters of bio diesel were produced from six liters of soybean oil, 600 ml of ethanol, and a small amount of sodium hydroxide to cause an exchange between the alcohol and oil called transesterification. The pH was adjusted to 8.5 using a lab meter and sodium hydroxide. The oil was then warmed before it was transferred to an Imhoff cone. Bio diesel collected at the top of the cone while glycerin and waxes settled to the bottom. Each liter of oil yielded 51% bio diesel by volume. The second phase compared the performance of the bio diesel to standard diesel in a 2003 Ford Excursionâ truck, powered by a 7.3-liter diesel engine and driven over a measured course. Bio diesel yielded 9% fewer miles per gallon than conventional diesel fuel as measured by the truck's on-

board computer. The truck was drained of fuel from the fuel-water-separating filter before each trial to prevent cross contamination. Three trials were performed using three independently produced volumes of bio diesel alternating with equal volumes of conventional diesel fuel. Miles per gallon were logged and the simple average reported. Non-toxic, environmentally safe bio diesel can be made on a small scale from soybean oil. Small batches have a direct cost of about $3.00 per gallon.

**Board 142 UPHOLSTERED WINDMILLS: HOW WILL VARIOUS FABRIC BLADE COVERS AFFECT THE EFFICIENCY OF A WINDMILL IN DIFFERENT WEATHER CONDITIONS? Anna L. Mohr, 07amohr@beaumontschool.org, 3079 Scarborough Rd., Cleveland Heights OH 44118. (Beaumont School)**

Windmills have been around for centuries. Used to harness the power of wind, a significant renewable resource, windmills and wind turbines may again become an integral component of the way that the world obtains its energy. This investigation tests the possible applications of fabric in the world of wind power. A small model-sized windmill was used to test the difference in wire wing forms covered with rip-stop nylon, burlap, a leather substitute, silk, and cotton. I hypothesized that of these fabrics, rip-stop nylon would perform with the greatest efficiency in the various weather conditions. Each of the covered wings was attached to the miniature windmill and tested by counting the number of rotations per 15 seconds when wind (provided by a hairdryer on cool, low power) was applied to the windmill. Each set of fabric wings was then tested during two simulated weather conditions. First, the wings were dipped in water to simulate rainy or wet weather conditions. Second, the wings were again dipped in water and then frozen overnight to reproduce conditions with temperatures below freezing. I tested each fabric-covered windmill in each of the mentioned conditions five times to produce more accurate results. Few of the fabric-covered wings performed during the rainy/wet condition. Only the set of the silk-covered wings was able to operate in the snowy/frozen conditions, indicating that, contrary to the hypothesis, silk is the most efficient and environment-ready fabric to prevent the buildup of excess water, snow, or ice on windmill blades.

**Board 143 EFFECT OF 20-HYDROXYECDYSONE ON LIMB REGENERATION IN THE SAND FIDDLER CRAB. Jacqueline M. Boltik, sk8grl786543@yahoo.com, 631 Driftwood Dr., Lake Milton OH 44429. (St. Vincent - St. Mary High School)**

The ability of specialized crustacia to regenerate damaged appendages has been an area of interest to scientists. The rate at which regeneration and molting occur in decopod crustaceans, specifically the fiddler crab, is regulated by the secretion of ecdysone by the y-organs. The purpose of the study was to determine whether an increased presence of 20-Hydroxyecdysone affects the rate of regeneration and budding of appendages following multiple limb autonomy (MLA) in the sand fiddler crab (*uca pugilator).* It was hypothesized that if elevated levels of 20-Hydroxyecdysone are maintained during the period following MLA, then the rate of regeneration of appendage will be greater in the experimental group where the hormone was introduced in comparison to the control group where the naturally occurring level was present. The sample was comprised of 100 male *uca pugilator*. After MLA, the number of organisms living decreased to 52. Organisms in the experimental group (n=26) were injected every other day with 50 pg of 20-Hydroxyecdysone in 0.05mL at the regenerate bud base. Likewise, the control group (n=26) was injected with 0.05mL of distilled water. The R-Index is a formula used in previous experiments to compare regeneration of organisms with varying sizes. The R-Index (carapace width (mm) divided by bud length (mm) x 100) was then calculated weekly from the date of MLA. The regeneration (R-Index) in the experimental group was greater than in the control group. The results suggest that ecdysone affects R-Index and rate or regeneration of appendage in *uca pugilator*. Greater knowledge of regeneration will provide for advancement in medical treatments. A hormonal control method to regulate cell division could potentially serve as a cure for cancer.

**Board 144 MECHANICAL ANNEALING OF 3-D POLYSTYRENE PHOTONIC CRYSTAL TEMPLATES. Kyle P. Mohler, mohlerpsktdh@msn.com, 256 Westview Ave., Wadsworth OH 44281. (Wadsworth High School)**

The purpose of this study was to determine if it was possible to eliminate structural defects, created during crystallization, from colloidal crystals. In past experiments, researchers have tried several different methods to reduce the defect levels in colloidal crystals, with minimal success. It is hypothesized that the process of mechanical annealing will affect the defect count in 3-D polystyrene colloidal crystals. The colloidal crystals were formed from uniform polystyrene spheres, 200 nm in diameter, using density differential crystallization. After formation, the crystals were subjected to oscillating sound waves of various amplitudes and frequencies, thereby allowing them to physically reorganize on the micro, as well as, macro scales. After the completion of the annealing process, the defect levels in the crystals were calculated and studied against other annealed and un-annealed slides using optical and atomic force microscopy. The study showed that when crystals were annealed under similar conditions, the average number of defects decreased as the annealing time progressed. The average number of defects also changed when the variables of amplitude and frequency were altered. The average number of line defects found in the crystals, however, increased in all slides at all frequencies and amplitudes as annealing progressed. This may be attributed to the convergence of point defects in the crystal due to the systems natural drive towards a state of equilibrium. Overall, the results indicated that it is possible to significantly reduce the average defect level in colloidal crystals through the process of mechanical annealing.

**Board 145 THE DESIGN AND PROGRAMMING OF A ROBOTIC DELIVERY TEAM. Elizabeth C. Coquillette, lcoquillette09@hb.edu, 2185 Harcourt Drive, Cleveland Hts. OH 44106. (Hathaway Brown School)**

The goal of this project was to design and program a robotic warehouse delivery team. It was hypothesized that this team could be built using two robots, one to act like a delivery truck and the other to sort and dispense. Each robot would have two parts—the robot itself and the program written on the computer and downloaded into the robot's memory. This robotic team was built using LEGO® pieces and LEGO® MINDSTORMS ™ software. LEGO® MINDSTORMS ™ was used only as a vehicle for construction and programming; this project was done without the use of any kits or instruction manuals provided by LEGO® or any other source. The results were that after a process of debugging the system, trials were 95% successful with the team built as follows: Robot 1 takes orders of yellow and blue bricks using two touch sensors. After receiving the orders, the robot uses a light sensor to follow the edge of a gray line and stops when it reaches a black square in front of Robot 2. Robot 1 then initiates an infrared communication program to communicate the number of each color of bricks ordered to Robot 2. This second robot then uses a light sensor to sort a random assortment of yellow and blue bricks into two separate dispensers and dispenses the correct number of each color of brick to Robot 1. After receiving the bricks, Robot 1 returns the colored pieces to the starting point. Computer programs unique to this project were written to instruct the robots on how to use their motors and sensors to interact with their surroundings, the bricks, and each other in order to accomplish their task with no human intervention. This design could be used to create an accurate and efficient automated item recovery system in a warehouse or storage facility.

**Board 146 ANALYSES OF HIGHLAND BEEF: MEAT QUALITY CHARACTERISTICS. Abigail B. Snyder, snyder@horizonview.net, 241 Whisler Road, Kingston OH 45644. (Zane Trace HIgh School)**

Highland cattle are a potentially important source of specialty beef and a unique gene sources for crossbred cattle operations. This study was designed to identify the following characteristics of purebred/grain fed, crossbred/grain fed, and purebred/grass fed beef: (1) tenderness, (2) back fat, (3) marbling, and (4) rib eye area. The results will be used to market Highland beef and enhance cross breeding programs. The hypothesis was that there is no significant difference between purebred/grain fed cattle harvested at 24-30 months, crossbred/grain fed cattle harvested at 17-19 months, and purebred/grass fed cattle harvested at 32-44 months in terms of: tenderness, back fat, marbling, and rib eye area. An Alpha Level of significance =/< .05 was established. Eighteen steaks from the 13$^{th}$ rib were aged 14 days, frozen to -20 degrees centigrade and sent to a meat lab. After thawing, back fat, marbling, and rib eye area measurements were taken. Steaks were then cooked consistently on a belted oven at 71 degrees Celsius. Six core samples were taken from each steak and shear force was tested. Data were collected and the results were analyzed using the one-way analysis of variance. No significant difference in tenderness was noted among the three groups. The crossbred/grain fed group was found to have significantly more back fat, rib eye area, and marbling than both the purebred/grain fed and purebred/grass fed groups. Further data collection is recommended to support the findings in this study to be used with breed EPDs

(expected progeny differences) to help reduce breed carcass variation.

**Board 147 CAN PEOPLE WITH TWO INTACT ARMS EXPERIENCE THE PHANTOM LIMB MIRROR BOX PHENOMENON? Annaliese Marie Kern, DancerGirl@columbus.rr.com, 4512 Zeller Rd., Columbus OH 43214. (Clintonville Academy)**

By viewing the reflections of their intact hands being stimulated, amputees are able to experience a shift of the stimulation to their "phantom limbs." People who are not amputees have not been shown to experience a similar shift in sensation from one intact hand to the other by using this mirror reflection technique. Non-amputees can, however, experience a shift in stimulation from a dummy hand to their own hand if their view of their own hand is blocked. These two techniques were combined in a procedure in which non-amputee subjects watched the mirror reflection of one of their hands being stimulated, but were blocked from actually seeing the stimulated hand. Ten persons, ranging in age from14-71, placed their right hands in their laps and their left hands through a window in an open-topped box. A flap on the box hid their hands from direct view; they were able, however, to see the reflection of their left hands in a mirror mounted on the right wall of the box. The experimenter then manipulated the hidden left hands of the subjects while they watched this manipulation in the mirror. Three subjects experienced the stimulation as being transferred to their non-stimulated right hand. This 30% response to the mirror reflection technique would not be expected to occur in non-amputees, and has never been demonstrated previously in this group.

**Board 148 VERMICOMPOSTING USING EARTHWORMS AND HUMUS. Kayla C. Emrick, semrick@insight.rr.com, 646 Randolph Ct., Worthington OH 43085. (Thomas Worthington High School)**

Earthworms are decomposers that turn table scraps into fertile humus. Different organic materials produce different amounts of humus when decomposed. The purpose of this study was to determine whether earthworms produce more humus when decomposing whole oranges, lettuce, or wood chips. Samples were taken from six compost bins, each of which contained the same amount of peat moss, water, and one of the organic substances, over a period of 21 days. For each substance, one of the set of two bins contained 15 earthworms. The hypothesis was that the bin with oranges and worms (Bin D) would decompose the fastest and produce the most humus. This hypothesis was shown to be correct. The oranges showed the earliest signs of decomposition, which included mold growth and odor. On day 21, the humus content of Bin D was measured at 4 out of a possible 5. The humus content was found using a Lamotte Humus Testing Kit (model STH-1, code 5021). After filtering the reagents in the kit, the color of the remaining water determined the score on a scale of one to five. The darker the water was, the higher the humus content. A successful compost bin requires a balance of nitrogen and carbon. Lettuce and wood chips alone do not contain a sufficient balance of carbon and nitrogen for vermicomposting. As a result, neither lettuce nor wood chips produced a significant amount of humus or showed early signs of decomposing. Oranges, however, do contain this balance. Because vermicomposting is becoming increasingly important in organic gardening, the results of this project are valuable to anyone interested in creating a healthier environment through composting.

**Board 149 WILL LIVESTOCK MANURE PROVIDE SUFFICIENT NUTRIENTS FOR NORMAL CORN AND SOYBEAN GROWTH? Andrew J. Haun, 7361 Township Road 163, West Liberty OH 43357. (Benjamin Logan High School)**

Livestock manure is a valuable resource when utilized as a natural source of plant nutrients, such as nitrogen, phosphorus, and potassium. In this study, potting soil composed of sand, vermiculite, and peat moss was divided into six equal portions, 1.36 kg each. Manure was added to four portions to obtain equivalent application rates: 1,120 kg/ha and 4,482 kg/ha of poultry manure and 2,241 kg/ha and 8,963 kg/ha of beef manure. Corn (*Zea mays L*.) and soybean (*Glycine max L*.) seeds were planted in 7.6 cm diameter plastic pots of potting soil with appropriate manure treatments, complete nutrient, and no nutrients. There were two replications of each treatment. All plants were kept moist with distilled water except for the plants that received the complete nutrient treatment. A complete nutrient solution was utilized to provide moisture and nutrients to the plants that were treated with complete nutrient mix. The plants were grown under fluorescent lights for five weeks. Evaluations were made by measuring shoot length, fresh weight of roots, and shoots, and dry weight of roots and shoots. The plants that received the complete nutrient mix had the longest shoot growth and greatest dry matter content and fresh weight. Fresh weight was lowest for both of the beef manure treatments for corn and soybeans. Shoot length was more variable in the corn across all comparisons than in the soybeans. All plants that received no nutrients and lower rates of manure exhibited foliar symptoms of nitrogen and potassium deficiencies. This project demonstrated that corn and soybeans can utilize nutrients provided by manure, but it is not a complete nutrient source.

**Board 150 TASTE PREFERENCES AND GENETIC SENSITIVITY TO SWEETNESS. Michael A. Sears, psears@ashland.edu, P.O.Box 998, Ashland OH 44805. (St. Peter's High School)**

Recent research has revealed that the taste sensitivity of people varies with the number of genetically determined papillae found on the tongue, which in turn determines the degree of taste sensitivity. Taste sensitivity is typically assessed by the sensitivity of subjects to chemicals like PROP (Propylthiouracil) and PTC (Phenylthiocarbamide) and the degree to which subjects experience the chemicals as bitter or tasteless. Very few studies have analyzed sensitivity to sweetness. The purpose of this study was to determine whether there a correlation exists between genetics (non-tasters or super-tasters) and their preference for different kinds of sweeteners. To test this notion, two hypotheses were formulated: H0: Regular pop will be most preferred by tasters; H1: Diet pop will be least preferred by tasters. To test the hypotheses an experiment was conducted with 57 students at Ashland University. The student subjects first evaluated the bitterness of two strips of filter paper. One strip was regular paper, and the other contained PTC. Subjects were asked to taste three numbered cups filled with either Pepsi™(sweetened with high fructose corn syrup and/or sugar), Diet Pepsi™ (sweetened with aspartame), or Pepsi Edge™ (sweetened with sucralose along with high fructose corn syrup and/or sugar). The subjects indicated which drinks they preferred the most and the least. A chi-square test revealed inconclusive, nonsignificant results for H0 but confirmed H1, the least preferred drink for tasters was Diet Pepsi™. (People with extra circumvallate and fungiform papillae can taste bitterness from aspartame when drinking Diet Pepsi).

**Board 151 A STUDY OF AGE RELATED MYELIN REPAIR. Kathleen E. Murphy, kem0389@aol.com, Robert H Miller, Anne K DeChant, 2845 S.O.M. Center Rd., Hunting Valley OH 44022. (Hathaway Brown School)**

A study of age-related myelin repair was conducted to determine whether younger, undifferentiated oligodendrocytes show a higher capacity to repair areas of myelin breakdown than mature adult oligodendrocytes. Demyelination occurs when myelin, the insulating sheath around axons in the spinal cord, is destroyed by oligodendrocyte death. This can lead to the loss of axons, neurons, and glial cells in the spinal cord and brain. Demyelination is a problem associated with neurodegenerative situations such as Multiple Sclerosis, Parkinson's Disease, and spinal cord injuries. The purpose of this study was to determine whether age affects the ability of oligodendrocytes to remyelinate. Because multiple sclerosis is a disease that is found primarily in adults, it was hypothesized that young cells would proliferate and remyelinate more effectively than mature cells. Neuronal cells dissociated from adult and neonatal mice brains were used to compare myelin production. Neonatal and mature neuronal cells were grown in culture and stained for myelin content with a specific antibody that stains for oligodendrocytes exhibiting myelin basic protein production. It was determined that younger cells have a greater capacity to produce myelin than adult cells because the neonatal culture showed a greater percentage of cells producing the myelin basic protein than the mature cell culture. In the near future, this data will be quantified by a numerical cell count. The results of this study provide many opportunities for further study. In future experiments, oligodendrocytes expressing the fluorescent protein from mice carrying the GFP gene will be injected into mice that do not express the fluorescent protein. Both neonatal and mature oligodendrodcytes will be injected into mice, so that the age difference may be studied both in adult mice and in neonatal mice in vivo.

**Board 152 THE RESPONSE OF GENETICALLY MODIFIED SOYBEANS TO ROUNDUP™ HERBICIDE. Hannah Cox, coxpj6@adelphia.net, (Jason Clark, jclark@horizonview.net), 946 SR 180 Chillicothe OH 45601. (Zane Trace High School)**

The purpose of this project was to find out how the effects of Roundup Ready™ herbicide affected the traditional soybean compared to the transgenic soybean. This study contrasted 25 genetically modified

soybeans and 25 traditional soybeans (Glycine Max) in response to Roundup Ready™ herbicide. The hypothesis of this project stated that genetically modified soybeans would be unaffected by Roundup Ready™, and the traditional soybeans would be negatively affected by the herbicide. When the soybean seeds were first planted, untreated water was used during the first two weeks to give the new seedlings a good growth start. Also a grow light was used to help the seedlings grow. After the first week, 3 grass seedlings (weeds) were added to grow alongside the soybean plants. After two weeks of this treatment, when the plant germination period was complete, 6 ounces of water was mixed with 5 drops of Roundup Ready™ herbicide. Roundup Ready™ is a herbicide that is leaf absorbed, so it is inactive once it touches the soil. In this experiment, the growth and health of the plant were evaluated for a twenty-one day duration. Plant height and leaf color were noted over this period of time. The leaf color was measured by a scale of green to yellow pigmentation. During this experiment, neither soybean type was affected by the herbicide since the plants lived for the duration of time tested. The results showed that the genetically modified soybean reacted poorly to this experiment, eventually wilting to death, and the traditional soybean reacted as the genetically modified soybean should have. The genetically modified soybean should not have responded to Roundup Ready™ and continued growth and improvement, while the traditional soybean should have died as a result of Roundup Ready™ application. Therefore this study is inconclusive. Further study will be done to determine the genetic structure of genetically modified soybeans in contrast to the genetic structure of traditional soybeans. This will show the molecular response of soybeans to herbicide.

**Board 153 HOW STRONG ARE ADHESIVES? Emre M. Kuguoglu, ekuguoglu@yahoo.com, 794 Boulevard St., Akron OH 44311. (Firestone High School)**

The purpose of this study was to identify the strongest type of adhesive for holding two wood pieces together and supporting the maximum amount of weight. Six different types of adhesives were tested in this study: Elmer's Carpenter Wood Glue®, Elmer's Multi Purpose Glue®, Elmer's Probond Wood Glue®, Epoxy®, Gorilla Glue™, and Titebond Original Wood Glue®. Each of these adhesives was applied to two pieces of wood to stick them to together. A total of twelve pieces of wood of equal size were used for the first set of tests. To better insure consistent results each test is repeated a minimum of three times. The dimensions for the wood pieces are 10 inches in length, 1.5 inches in width, and ¾ of an inch thickness. These wood pieces were glued together in pairs, dried and tested. The strength test was conducted at the University of Akron Materials testing facility. The results were recorded for each test and analyzed. The test results showed that the strongest adhesive was Elmer's Probond Wood Glue® with a maximum strength of 1633 $Ib/in^2$. The weakest are Gorilla Glue™ and Epoxy®. A survey of 45 people were asked which product consumers would prefer to use. The test and survey show that the consumers are mislead into buying the wrong type of adhesives, because of the advertisements on the labels.

**Board 154 PLANARIAN REGENERATION WITH *SYMPHYTUM OFFICINALE*. Chelsea M. Boch, cboch@cjeagles.org, 232 Woodbury Dr., Dayton OH 45415. (Chaminade Julienne High School)**

Planarians (*Planaria fissipara*) are one of the few animals that have the ability to regenerate their cells. When cut, Planarians can regenerate their entire bodies due to the presence of stem cells (neoblasts). Comfrey root (*Symphytum officinale*) is a regenerative substance composed of many nutrients including, calcium, vitamin A, and vitamin C. The purpose of this investigation is to show the effect of comfrey root on planarian regeneration. The hypothesis is that comfrey root will help the planarians to grow back at a quicker rate because of the herbs' regenerative chemistry. Six cut planarians were placed in a mixture of spring water and comfrey root. Six additional planarians were placed in spring water as controls. On the sixth day of the investigation nine of the possible of twelve in the comfrey solution had fully regenerated as compared to five of the possible twelve planarians in the spring water alone. This study suggests that comfrey root could be used to further stem cell research and the regeneration of human tissue.

**Board 155 OXIDATIVE STRESS IN A NEWBORN MOUSE MODEL OF HUNTINGTON'S DISEASE (HD): UNEXPECTED DIFFERENCE BETWEEN R6/2 HD AND WILDTYPE GENOTYPES. Dylan H. Young, actorguy24@mac.com, 1650 Ridgeview Road, Upper Arlington OH 43221. (Upper Arlington High School)**

Huntington's Disease (HD) is a genetic disorder caused by mutation in the gene for the essential huntingtin protein that leads later in life to selective destruction of the brain. The normal gene contains a 5'CAG codon repeat (5-35 repetitions), while the disease gene contains more repetitions. A transgenic mouse model (R6/2) has been developed using portions of the human huntingtin gene with extended CAG repeats. There is substantial evidence that oxidative stress is involved in the pathology of the disease. Primary neuron cultures were established from the forebrain of newborn R6/2-HD mice and their wildtype (WT) littermates. Cultures were stained with fluorescent dyes specific for intracellular antioxidants and reactive oxygen species. Fluorescence intensity reflected the quantity of molecules in hundreds of living cells and was captured by fluorescent microscopy, time-lapse photography, and computer recognition. CMFDA, a stain for intracellular thiols, and MCB, a stain highly specific for glutathione, showed no significant difference between HD or WT derived cells ($p > 0.05$). However, staining with DHE, which is specific for superoxides ($\cdot O_2^-$), showed significantly higher staining in WT cells than HD cells ($p=0.009$). This is surprising since neurons from later disease stages (humans or model systems) generally show higher $\cdot O_2^-$ in HD compared to normal neurons. When both types of cells were stimulated by the neurotransmitter glutamate, WT cells responded more vigorously than HD cells and produced $\cdot O_2^-$ at a significantly greater rate. Because the neurons were examined early in life, the lower $\cdot O_2^-$ in HD cells may reflect early signs of weakened or slowed electron transport/oxidative phosphorylation.

**Board 156 THE EFFECT OF AIR PRESSURE ON COLLISIONS OF A SOCCER BALL. Brian M. Keske, artkeske@sbcglobal.net, 1545 Langdon Drive, Centerville OH 45459. (Dayton Christian High School)**

Does increasing air pressure in a soccer ball always increase the rebound in collisions? It was hypothesized that at low air pressure levels the rebound is essentially equal against a concrete floor or a wooden board that is unsupported at the center. As air pressure is increased, the rebound consistently increases in collisions with the floor but increases at a lower rate, then falls, in collisions with the board. A two ft. length of 2 x 10 board was secured at each end, with no support under the middle. A soccer ball inflated to six PSI was dropped 84" for eight trials each onto the board and onto a concrete floor. The heights of the rebounds were video-recorded. This was repeated at two-PSI increments thru eighteen PSI. It was observed that at six PSI rebound was almost identical (48") for concrete and wood. For collisions with the concrete floor, increasing air pressure always increased rebound heights. The rate of increase gradually decreased with increasing air pressure. For collisions with the wooden board, increasing air pressure increased rebound heights at a lower rate, with rebounds peaking at 58.6" at sixteen PSI, and decreasing by 0.6" at eighteen PSI. The data showed that increasing air pressure may increase or decrease the rebound in collisions, depending on the material properties of the object with which the ball collides. Increasing the air pressure may possibly reduce the duration of the collision. This may reduce damping of vibration, causing additional collision energy to be lost.

**Board 157 EFFECTS OF ZINC SULFATE ON A549 LUNG EPITHELIAL CELLS. Jing-Jing Chen, gazingstars@gmail.com, Pamela M. Ban, flutistchick08@gmail.com, 7958 Lazelle Woods Dr., Westerville OH 43081. (Thomas Worthington High School)**

Zinc is a component of numerous enzymes that are crucial for cell growth and division. Clinical observations have shown that adults and children who are zinc-deficient are susceptible to respiratory infections. However, it is poorly understood how zinc affects lung epithelial cells. Actinomycin-D (ACTD) is a chemical that may inhibit DNA synthesis, resulting in cell death. The purpose of this study was to determine the effects of $ZnSO_4$ on cell proliferation and ACTD-induced cell death in A549 lung epithelial cells. A549 cells were cultured in 12-well culture clusters in medium containing 5% fetal bovine serum and 1% antibiotics. Various $ZnSO_4$ concentrations of 25, 50, 100, 150, and 200μM, with or without ACTD, were added to the medium and incubated for 24 hours. Cells were then detached, stained, and counted. The control cells were grown in similar conditions without $ZnSO_4$ or ACTD. While 25-100μM $ZnSO_4$ promoted cell proliferation, 150μM and 200μM caused cell deaths. 25-100μM $ZnSO_4$ significantly reduced ACTD-induced cell death. These results show that zinc promotes cell proliferation and protects cells from death caused by ACTD. In conclusion, moderate amounts of zinc may prevent cell death caused by harmful chemicals, but excessive amounts of zinc are toxic to cells.

**Board 158 THROWN FOR A CURVE: THE PHYSICS OF A CURVEBALL. Aaron J. Scheid, ascheid@cjeagles.org, Travis W. Pfander,**

**tpfander@cjeagles.org, 47 Spirea Drive, Dayton OH 45419. (Chaminade-Julienne Catholic High School)**

When a pitcher throws a baseball, the pitch is imparted with spin and velocity to induce a curved trajectory scientifically defined by the Magnus force. The purpose of this study is to examine and rank the variables of spin and velocity that compose the Magnus force. A graphic pitch simulation is used to compare a theoretical pitch under standard conditions to a spinning pitch of equivalent velocity that has been influenced by the Magnus force. The hypothesis is that the resulting graphs will show that spin has the greatest impact on the curve displacement between the control and the pitch including Magnus force. After running simulations, data was collected according to isolated variables of velocities of 55, 65, and 75 mph and spin rates of 1200, 1500, and 1800 rpms. Sample data from 55mph velocity shows approximate displacement of 0.23meters at 1200rpms, 0.28meters at 1500rpms, and 0.32meters at 1800rpms. Sample data from 1200 rpm angular velocity shows approximate displacement of 0.23meters at 55mph, 0.27meters at 65mph, and 0.26meters at 75mph. In conclusion, spin has the most consistent effect on pitch curve, but each pitch velocity possesses an ideal rate of spin that induces optimum curve displacement.

**Board 159 ETHANOL FROM CORN GRAIN AND STOVER. Elizabeth J. Bailey, JWBailey97@aol.com, 23447 Emmons Rd., Columbia Station OH 44028. (Columbia High School)**

The amount of ethanol produced from corn grain and stover (cellulosic matter remaining after grain harvest including husks, leaves and stalks) was measured to determine the feasibility of using the entire corn plant to produce ethanol. It was hypothesized that producing ethanol from corn stover in addition to the grain would improve the economics of growing corn to produce fuel. Finely ground, 10 g, stover and grain samples were pretreated with 1M hydrochloric acid, then processed with 1 g of amylase or cellulase enzyme to produce glucose. The glucose was fermented with 1.4 g Baker's yeast (*Saccharomyces cerevisiae)* to produce ethanol and $CO_2$. The reaction progress was monitored by measuring the $CO_2$ using water displacement. The grain, 65% by weight of the total plant, produced 93.7% of the ethanol. The use of stover is attractive because of its positive energy balance; however, an economic estimate, based on published Ohio custom farm rates, showed that it is not cost effective because the harvesting cost, $18/ T, exceeds the value of the ethanol produced, $14.13/ T. Stover byproducts have low feed value. In contrast, the protein byproducts from the grain are used as animal feed and are an important factor making the production of grain ethanol economically feasible. Ethanol from corn stover is currently not cost effective; however, changes in stover handling and chemical processes that both reduce harvesting costs and improve the ethanol yield could help stover become an economically feasible renewable fuel.

**Board 160 BIPOLAR DISORDER AND SHORT-TERM MEMORY. Lina Dayem, ldayem09@hb.edu, 26300 Village Lane #301, Beachwood OH 44122. (Hathaway Brown School)**

The purpose of this study was to determine effect the bipolar disorder has on a person's ability to perform on various short-term memory tests. The study considered the variables of age, gender, type of bipolar disorder, ability to work, psychosis, age of onset, and how long the patient has had the. It was hypothesized that if a pool of bipolar subjects and a control group without the disorder were given various short-term memory tests, then the bipolar subjects would perform worse. This hypothesis was based on the fact that the memory system and the emotion system are operated by the same area in the brain. The procedure was to first collect data about the 32 control and 30 bipolar subjects' history. Then memory tests from the Wide Range Assessment of Memory and Learning and the Rey Figure Test were administered to them. The tests were then graded and statistical analyses were conducted on the SPSS program. The hypothesis was partially supported. Six of the eight short-term memory tests showed a significant difference (d".05; at least 95%) in means between the bipolar group and the control group. The tests that bipolar subjects did the worst on were the sentence memory test and the Rey Figure copy and recall. Subjects in different variable groups performed differently. In regards to symptomatic episode, patients in a stable state at the testing performed better on the verbal learning test and patients in a mixed state did worse on the sentence test than patients experiencing any other episode. Subjects with bipolar disorder Type II did worse on the story test than subjects with Type I. Male patients scored lower on the story and number/letter memory tests than females. Subjects without psychotic symptoms did better on the verbal learning and number/letter memory test than subjects with psychotic symptoms. Patients who had the illness longer scored lower on the Rey Figure copy.

**Board 161 HIDDEN ETHYL ALCOHOL IN SODA POP, FLAVORED BEVERAGES AND OTHER FOOD ITEMS. Gregory M. Lavins, Glavins91@aol.com, 32380 Tracy Lane, Solon OH 44139. (Solon High School)**

The purpose of this study was to determine whether beverages with added flavorings such as sparkling flavored water, juice drinks and soda pop contain trace amounts of ethanol (ethyl alcohol). The hypothesis was that beverages with these types of flavorings would have small amounts of alcohol because of fermentation.
The project involved testing 45 beverages and 11 non-beverages. Each item was tested for the presence of ethanol by using a headspace Gas Chromatograph.
For the beverages, the average ethyl alcohol concentration was 0.0238 % (v/v). The concentrations ranged from 0 – 0.2135 % (v/v). The highest amount of ethanol was found in Snapple® Juice Drink Fruit Punch at 0.2135 % (v/v).
The highest concentration of alcohol in the non-beverages group was found in Tones® Almond Extract at 31.641 % (v/v). The findings in this study indicated that many of the beverage and non-beverage samples contained ethanol. The data also showed that the amount of ethyl alcohol in the beverage group was too small to be harmful or to cause impairment in the human body. The literature indicated that many food and beverage manufacturers add ethanol as a carrier for volatile and natural flavorings. Thus the products were not fermenting and producing the ethanol. Beverages with less than 0.50 % (v/v) ethanol are considered non-alcoholic.
The study indicates that ethanol is present and is unindicated on the product label on many common sparkling flavored waters, juice drinks, soda pop and non-beverage items. This research has implications for people wishing to avoid ethanol and raises concerns about potential interference with forensic breath alcohol testing instruments.

**Board 162 OPTIMIZING ROCKET ENGINE PERFORMANCE. Michael J. Anthony, fraznic@yahoo.com, David James Bishop, silly_rabbi1@yahoo.com, 5079 TR 339, Millersburg OH 44654. (West Holmes Middle School)**

This project supports our hypothesis that substituting potassium perchlorate for potassium nitrate in an epoxy based rocket formula increases the burn rate of a propellant. A potassium nitrate propellant developed by David Muesing, an amateur rocketeer, was modified by substituting part of the potassium nitrate with potassium perchlorate. Three formulas were tested. KP0 was the original formula developed by David Muesing (epoxy 19%, Fe2O3 1%, Magnesium powder10% and potassium nitrate 70%). KP10 substituted 10% of the potassium nitrate with potassium perchlorate and KP20 substituted 20% of the potassium nitrate with potassium perchlorate. Strand testing (measuring the burn rate of rods of propellant in open air), were performed 3 times on each formula. The average burn rate of KP0 was 33 seconds /inch. The average burn rate of KP10 was 23.5 seconds/inch and the average burn rate of KP20 was 21.5 seconds/ inch. One rocket engine of each formula was constructed and fired on our test stand. The thrust data was obtained for KP0 and KP20. The 3 formulas were filmed with a digital camera and significant flame time measured. Significant flame was determined when a flame greater than 2 inches in height was observed on a picture frame. The time when greater than 1 pound of thrust was observed was: 3.2 seconds in the KP0 engine and 2.3 seconds in the KP20 engine. The time visual burning was observed for each engine was: 4.17 seconds in the KP0 engine, 3.56 seconds in the KP10 engine and 2.54 seconds in the KP20 engine. "Significant flame" time consistently overestimated the period of time the engine produced thrust. There was good correlation with all three measurement parameters. As higher percentages of potassium nitrate were substituted with potassium perchlorate the burn rates increased in all measurable categories. The substitution of 20% potassium perchlorate also increased the specific impulse of the original formula by 50% to 158 seconds from 108 seconds. The average thrust of the KP20 engine (25 pounds) was twice that of the engine with the original formula (12.7 pounds).

# Environmental Sciences
## 9:00 AM Saturday April 22, 2006
## TBA - Presiding
## Science Center Room 62

**9:00 HOW DEMOGRAPHICS INFLUENCE PRODUCTION PRACTICES WITHIN THE OHIO MAPLE SYRUP INDUSTRY. Gary W. Graham, graham.124@osu.edu, P. Charles Goebel, goebel.11@osu.edu, Randall B. Heiligmann, heiligmann.1@osu.edu, Matthew S. Bumgardner, mbumgardner@fs.fed.us, Ohio State University Extension, 1680 Madison Ave., Wooster OH 44691.**

Maple syrup production contributes $5 million annually to Ohio's economy and provides a supplemental income to many forest landowners. Despite over 90 years of service by Ohio State University (OSU) Extension, little information is available concerning the Ohio maple syrup industry. The primary aim of this research was to investigate the association among production factors and demographic characteristics of the Ohio maple syrup industry and examine the influence of OSU Extension programming on the industry. In 2004, a detailed survey was sent to all known Ohio maple syrup producers (*N* = 761) with the goal of elucidating relationships among production factors and demographic characteristics. Eighty-one percent (*n* = 620) of the surveys were returned by active maple syrup operations. Specific industry characteristics examined were producer heritage (Amish, non-Amish or non-Amish), producer age, sap collection methods (bucket or tubing), participation in OSU Extension educational programming, and size of the sugaring operation based on total number of taps. Chi-square analyses revealed that there are important differences among demographic groups (Ü = 0.05). For example, Amish producers have significantly larger sugaring operations, utilize bucket collection systems rather than more advanced tubing systems, and are younger than their non-Amish counterparts. Amish producers are also less likely to attend OSU Extension programming than their fellow Non-Amish producers, while older non-Amish producers with large operations and tubing systems were more likely to attend. These results will enable educators to develop programming to improve outreach and engagement efforts to currently underserved sectors of the industry.

**9:15 USE OF AMPHIBIAN INDEX OF BIOTIC INTEGRITY (AMPHIBI) TO EVALUATE CONSTRUCTED WETLANDS IN HAMILTON AND BUTLER COUNTIES. Thomas A. Schneider, tom.schneider@epa.state.oh.us, Joseph E. Bartoszek, joe.bartoszek@epa.state.oh.us, Ohio Environmental Protection Agency, 401 East Fifth Street, Dayton OH 45402.**

A protocol developed by Ohio EPA utilizes ten funnel traps set, evenly spaced around the perimeter of a wetland, three times per year (March, April, June) to monitor macroinvertebrates and amphibians in wetlands. An amphibian index of biotic integrity (AmphIBI), developed by Ohio EPA, was used to evaluate amphibian communities of 12 emergent and ephemeral created wetlands, sampled from 2001-2004, located in Butler and Hamilton Counties. The AmphIBI was first developed to evaluate natural wetlands under various disturbance regimes. It is composed of five metrics: relative abundance of tolerant species, relative abundance of sensitive species, number of pond breeding salamander species, presence of spotted salamanders or wood frogs, and an amphibian quality assessment index (AQAI). The AQAI utilizes coefficients of conservatism and abundance for each of the amphibian species present. Sampling was conducted at baseline, constructed, and reference sites. Amphibian communities, as represented by trap results, were compared using AmphIBI scores to assess the wetlands' function as amphibian habitat. AmphIBI scores were discriminatory between baseline (AmphIBI = 0), reference (47), and constructed (median 0, range 0-30) wetlands. Constructed, emergent wetlands had scores much lower than reference wetlands (median of 0 compared to a median of 47 respectively) suggesting that replacement of amphibian habitat function in constructed wetlands is not easily or regularly achieved.

**9:30 THE USE OF SOIL PARAMETERS AS INDICATORS OF HUMAN DISTURBANCE IN WETLANDS. Abby Rokosch[1], rokosch.1@osu.edu, Virginie Bouchard[1], bouchard.8@osu.edu, Siobhan Fennessy[2], fennessym@kenyon.edu, Richard Dick[1], dick.80@osu.edu, [1]Ohio State University, Environmental Science Graduate Program, School of Environment and Natural Resources, 2021 Coffey Rd., Columbus OH 43210, [2]Kenyon College, Dept of Biology, Gambier OH 43022.**

Current methods of wetland assessment rely strongly on the use of biological indicators such as vegetation and amphibians and the presence or absence of landscape stressors. However, many lack an in-depth analysis of physical, chemical, and biological soil parameters. The objective of my research was to determine if soil parameters (e.g., aggregate stability, bulk density, organic matter, total carbon (C), microbial biomass C, and enzyme activity) could be used as indicators of human-induced disturbance in wetland ecosystems. Three high and three low quality forested-depressional wetlands located in central Ohio were selected. Quality was determined using data collected by the Ohio Environmental Protection Agency. Wetlands were sampled three times throughout the study. Eight soil cores were taken at each wetland. Cores were used for the enzyme assay, a colorimetric determination of the amount *p*-nitrophenol released. Because soil is the primary foundation for several biogeochemical functions that occur in wetlands the hypothesis was that soil parameters (i.e., enzyme activity) would be sensitive to disturbance. Initial data suggest that ß-glucosidase and arylsulfatase activity are not significantly different among high and low quality sites. In high and low quality sites, mean ß-glucosidase activity was 820 + 630 and 590 + 210 µmol PNP $g^{-1}h^{-1}$ respectively (P=0.3); mean arylsulfatase activity was 1050 + 410 and 770 + 230 µmol PNP $g^{-1}h^{-1}$ respectively (P=0.1). A more complete chemical and physical analysis of the soil may provide support for the hypothesis however data on these parameters are incomplete. This research will be continued until July of 2006.

**9:45 TRANSPORT AND REMOVAL OF NITRATE IN AGRICULTURAL HEADWATER STREAMS. Kyle S. Herrman[1], herrman.2@osu.edu, Virginie Bouchard[1], bouchard.8@osu.edu, Richard H. Moore[2], moore.11@osu.edu, [1]The Ohio State University, School of Environment and Natural Resources, Columbus OH 43210-1085, [2]The Ohio State University, Human and Community Resource Development, Columbus OH 43210-1010.**

The objective of this on-going study is to determine which biotic and abiotic factors control denitrification in headwater streams located within agricultural watersheds. We hypothesized that forested riparian land use would increase carbon supply and increase contaminant travel time and thus favor nitrate removal via denitrification. Paired, 50-meter reaches are being examined (one agricultural/urban reach with heavy channelization and one forested reach) along five headwater streams (n = 10) in the Upper Sugar Creek Watershed in Northeast Ohio (40°51'42"N, 81°50'29"W). Currently, we have collected data from late summer and fall of 2005. Agricultural/urban and forested reaches have similar carbon supply in terms of dissolved organic carbon concentrations (2.93 ± 1.15 and 2.85 ± 1.18 mg C $L^{-1}$, respectively; mean ± 1 standard deviation; p = 0.698) and sediment carbon content (3.38 ± 0.68% and 3.53 ± 1.00%, respectively; p = 0.689). The hydrology data suggest that the forested streams have longer contaminant travel times than the agricultural/urban streams (1880 ± 1560 and 925 ± 562 s, respectively; p = 0.093, data was log transformed to satisfy normality). After 2 seasons of data there does not appear to be any significant difference between nitrate uptake lengths of agricultural/urban and forested reaches ($2.1 \times 10^5 \pm 4.8 \times 10^5$ and $7.7 \times 10^4 \pm 2.0 \times 10^5$ km, respectively; p = 0.9315, data was log transformed to satisfy normality). However, there is a significant difference between nitrate uptake lengths in the summer and fall ($8.0 \pm 9.2$ and $2.9 \times 10^5 \pm 4.8 \times 10^5$ km, respectively; $p < 0.001$, data was log transformed to satisfy normality). This research will continue over another 1.5 years in order to provide clearer conclusions.

**10:00 PATTERNS OF DISSOLVED OXYGEN, PRODUCTIVITY AND RESPIRATION IN OLD WOMAN CREEK ESTUARY. Linda P. Cornell[1], lcornel@bgsu.edu, David M.Klarer[2], david.klarer@oldwomancreek.org, [1]Bowling Green State University-Firelands Campus, Dept of Natural and Social Sciences, 1 University Dr., Huron OH 44839, [2]Div of Wildlife, Ohio Department of Natural Resources, Old Woman Creek, NERR.**

Old Woman Creek estuary is a National Estuarine Research Reserve (NERR) located on the south shore of Lake Erie between Sandusky and Vermilion, Ohio. Since 2002, water quality data (dissolved oxygen (DO), depth, temperature) have been collected every 15 minutes using data loggers at four locations as part of the NOAA's NERR System Wide Monitoring Program. To determine ecosystem trophic conditions in Old Woman Creek, daily primary productivity, respiration, and net productivity are estimated from DO data for two monitoring sites during April and August, 2004. One site is located in the creek proper upstream of the estuary; the other is in the estuary near the mouth. It is hypothesized that diurnal changes in DO will yield accurate estimations of the system's primary productivity. Daily trends in DO and temperature exhibited distinct diurnal fluctuations at each site during both months. Typically, DO increased about 30% during daylight, then decreased at night. Storm events (indicated by sharp increases in

creek depth) disrupted diurnal patterns at both sites. In April, primary productivity in the creek was lower (below 1.9 g/m$^2$/day) than in the estuary site (up to 4.0 g/m$^2$/day ). In August, respiration exceeded primary productivity for much of the month in the creek, while in the estuary, primary productivity rates were frequently between 5–10 g/m$^2$/day. Care must be taken when using the oxygen data to determine primary productivity and respiration in this freshwater estuary. During storms and lake intrusion, physical dynamics dominate the system and overwhelm biological productivity and respiration.

**10:15 NICKEL AVAILABILITY DETERMINATION BY UREASE ACTIVITY IN SOIL. Shuo Yu, yu.288@osu.edu, Warren A. Dick, dick.5@osu.edu, 1158 Madison Avenue, #36, Wooster OH 44691-4123.**

Due to health and environmental effects of nickel (Ni), the available, not total concentration of Ni in soil must be accurately measured to properly assess its potential risk to plants, animals, and humans. A method to measure the concentrations of available Ni in soil was developed using a bioassay involving urease activity. Urease has an absolute requirement for Ni to function. The amount of available Ni in soil can be quantified by developing a titration curve and relating urease activity to known Ni availability as determined by a titration event. Bacteria with urease activity were enriched from Spinks sandy soil by growing the cells in Luria Broth medium. This created a culture with high amount of potential urease activity but with low actual activity because of Ni limitations. Ten mL of culture were applied to each acid-rinsed Spinks sandy soil sample and concentrations of Ni salt from 0 to 5 mM were added. The urease response to the added Ni was measured using steam distillation. When Ni concentration increased, urease activity also increased from 0 to 49 μg NH3-N produced, proving that urease activity is positively correlated to available Ni concentrations in soil.

**10:30 THE ESTABLISHMENT OF PLANT- AND MICROBIAL-MEDIATED FUNCTIONS IN CREATED DEPRESSIONAL WETLANDS OF CENTRAL OHIO. Katie Hossler, hossler.3@osu.edu, Virginie Bouchard, bouchard.8@osu.edu, Ohio State University, Environmental Science Graduate Program, School of Natural Resources, 2021 Coffey Rd., Columbus OH 43210.**

Natural depressional wetlands play an important role in the cycling of carbon, nitrogen and phosphorus. However, under current U.S. wetland policy, a natural wetland can be destroyed if the loss is mitigated by the construction of a new wetland. The purpose of this study was to evaluate the ability of created wetlands to develop the plant and microbial functions necessary to replace natural wetland C, N and P cycling. Our hypotheses were: 1) primary productivity would develop in created wetlands over the short term (~5-8 years), while microbial activities would take longer (> 12-15 years) to develop and 2) created wetlands would be N and P limited. Ten created freshwater depressional wetlands (ages 0.5-39 years) and five natural freshwater depressional wetlands located in central Ohio were selected for this study. Peak standing biomass and three soil cores were collected from three to five plots at each site. Soil samples were analyzed for denitrification enzyme activity, potential methane production, and basal respiration under various combinations of C, N and P. The younger created wetlands had lower plant productivity and microbial activity than the older created and natural wetlands (MRPP; $p=0.005$ and $p<0.001$, respectively). The nutrient addition studies indicated that C and N (and not P) were limiting in all of the wetlands, particularly in the younger created wetlands. These results suggest that in the short-term, created wetlands fail to mitigate the loss of natural wetland nutrient cycling, but may develop effective nutrient cycling over the long-term.

# Medical & Social Sciences
# 9:00 AM Saturday April 22, 2006
# Robert Cikraji - Presiding
# Science Center Room 64

**9:00 ROLE OF PLATELET-RICH PLASMA IN ACCELERATION OF BONE FRACTURE HEALING. R. Jordan Bohinc, Rbohinc04@hotmail.com, Wylan C. Peterson, wpeterson1@hotmail.com, Andrea Hoffmann, hoffmann.3@wright.edu, Richard Simman, richard.simman@wright.edu, Wright State University, 3640 Colonel Glenn Hwy, School of Medicine, Dept of Surgery, 238 Health Sciences, Dayton OH 45435-0001.**

Platelet-rich plasma (PRP) is a common therapy for acceleration of maxillofacial bone healing. PRP-associated benefits include growth factor production for promotion of blood coagulation, tissue repair and bone mineralization. This study analyzed the role of PRP in acceleration of long-bone fracture healing in 22 Lewis rats. Normal saline (control) or PRP (0.5ml PRP activated with 50U thrombin) were applied once to open femur fractures followed by analysis of fracture healing after 4 weeks. Radiographic analysis demonstrated a significantly higher callus to cortex ratio ($p<0.05$) in the PRP group (1.65±0.05) compared to the control group (1.47±0.06), indicating PRP-dependent acceleration of callus formation. Three-point load bearing analysis showed an increasing trend in bone rigidity (Newton Force) for the PRP-treated groups (60.85±6.06N) versus the control (47.66±5.49N; $p=0.1189$). H&E staining showed enhanced bone formation at the fracture site following PRP treatment compared to the control. In addition, immunohistochemistry demonstrated enhanced appearance of growth factors TGF-beta1 and BMP-2 in the control compared to the PRP group suggesting early downregulation of these growth factors during PRP-accelerated bone healing. In summary, our results demonstrate that PRP accelerates bone fracture healing of rat femurs via early onset of TGF-beta1 and BMP-2 growth factor expression, thereby promoting enhanced callus formation and bone repair.

**9:15 THE EFFECT OF 3,4 – DIAMINOPYRIDINE ON THE RECOVERY OF FATIGUED DIAPHRAGM TISSUE OF RATS. Michele G. Ionno, mionno@wooster.edu, Sharon Lynn, slynn@wooster.edu, Erik van Lunteren, M.D., erik.vanlunteren@case.edu, The College of Wooster, Box # 1906, 1189 Beall Ave, Wooster OH 44691.**

The physiology of muscle fatigue has two components: molecular depletion and a required recovery period. The depleted molecules include intracellular calcium, sodium, potassium ions and ATP. Because of this depletion, fatigue can be defined as the reduction in force-generating capacity that results from prolonged activity. We investigated the effects of 3,4–Diaminopyridine (DAP), an inotropic agent which increases muscle contraction, on recovery from fatigue (i.e., the period of time which the tissue re-accumulates what was lost during activity). We hypothesized that DAP would decrease the amount of time isolated rat diaphragm tissue needs to recover from a specified amount of fatigue. Muscle strips (n=40) were mounted in a bath of Krebs solution and stimulated to fatigue. Contractions were recorded by a force transducer. Muscle strips were fatigued for a period of 1 or 4 minutes, at either 20 or 50 Hz stimulation. Immediately after fatigue, 0.1 mL of DAP or the control (Krebs solution) was added and 20 minutes of recovery followed at 0.1 Hz; where time to half-relaxation and contraction and normalized force were measured. Data were compared using paired t-tests at 7 and 20 minutes (to investigate DAP affect early and late in recovery), followed by Bonferonni correction for multiple comparisons. Contraction parameters for normalized force between the two groups were significant ($p<0.05$) in all protocols but 20Hz – 1 minute ($p=0.188$). Our data suggest that DAP did decrease the time needed for recovery from fatigue. Deviations from this conclusion may be attributed to a small statistical sample size.

**9:30 THE EFFECT OF FOLIC ACID ON CHONDROCYTES TREATED WITH VALPROIC ACID. Tiffany Grubb, t-grubb@onu.edu, (Amy L. Aulthouse, a-aulthouse@onu.edu), Ohio Northern University, 402 W. College Ave, Unit 2418, Ada OH 45810.**

Valproic acid (VPA) is an antiepileptic drug known to cause many adverse teratogenic effects on humans as observed in clinical, animal, and *in vitro* studies. Folic acid (FA) is a vitamin recommended to expectant mothers to prevent neural tube defects and to aid in development. This study looked at the effect of FA as a preventative agent against the known teratogenic effects of VPA on chondrocyte mitosis and matrix production in agarose cultures. The cultures were grown for three weeks and treated with either 100µg/mL of VPA (n=40), 0.02µg/mL of FA (n=40), both drugs simultaneously (n=40) or with FA for one week then continued along with VPA for the remaining two weeks (n=20). An untreated control group was also included (n=40). A trypan blue exclusion assay was performed to analyze cell viability. A total cell count of both single cells and cell clusters composed of two or more cells evaluated mitotic activity. Matrix production was assessed by alcian blue staining. Analysis using a one-way ANOVA was used to compare both mitotic activity and matrix production of single cells and cell cultures. Preliminary data suggests that there is no difference between FA clusters and normal control clusters.

Therefore, FA at this dose neither enhances nor interferes with mitosis. The preliminary data also suggests that there is a decrease in the number of clusters in VPA cultures when compared with normal controls. A similar observation can be made on cultures treated concurrently with VPA and FA. Alcian blue staining is currently being evaluated.

**9:45 ROLE OF HYALURONIC ACID TREATMENT IN THE PREVENTION OF KELOID FORMATION. Jessica L. Hoying, jess4914@earthlink.net, Andrea Hoffmann, hoffmann.3@wright.edu, Richard Simman, richard.simman@wright.edu, Wright State University, 3640 Colonel Glenn Hwy, School of Medicine, Dept of Surgery, 238 Health Sciences, Dayton OH 45435-0001.**

Keloids are benign dermal scars that extend over the boundaries of the original injury. Keloids are characterized by enhanced fibroblast proliferation within the wound bed and altered extracellular matrix deposition, i.e., decreased production of hyaluronic acid (HA). This study uses keloid fibroblast culture to determine the effects of HA in the prevention of keloid scarring. One normal (NF1) fibroblast culture and five keloid (KF1,KF2,KF3,KF4 and KF5) fibroblast cultures were analyzed for TGFb1 expression and proliferation following 72h treatment with or without 10mg/ml HA. In Western-blotting, HA demonstrated no changes in TGFb1 expression in NF1 compared to the non-treated control. In contrast, KF1 and KF4 showed reduced TGFb1-expression following 72h HA treatment. ELISA analysis demonstrated similar TGFb1 secretion levels in NF1 following 72h HA (276.5±30.37pg/ml) compared to the control (211.4±64.65pg/ml). Thus, KF1 showed no changes, four of the keloid fibroblast lines KF2,KF3,KF4 and KF5 demonstrated a decreasing trend in TGFb1 secretion levels following HA treatment (e.g., 501.8±112.6pg/ml; KF2 vs. 420.3±73.53pg/ml; KF2+HA). NF1 demonstrated no changes in proliferation activity with 98±5.81% of the control. In contrast, keloid fibroblasts demonstrated a significant decrease ($p<0.001$) in KF3 proliferation activity following HA treatment (68.59±2.06%) compared to the KF3 control (79.06±2.8%). All other keloid cultures, e.g., KF1,KF2,KF4 and KF5 showed a similar decreasing trend in percent proliferation following HA treatment. The results demonstrate that HA is able to reduce TGFb1 expression and secretion in keloid fibroblasts. The HA-dependent reduction of TGFb1 growth factor levels is suggested to initiate the observed reduction in keloid fibrobalst proliferation activity.

**10:00 STRESS RESPONSE TO PROLONGED CAPTURE AND FOOD AVAILABILITY IN HOUSE SPARROWS (*Passer domesticus*). Anthony J. Porter, Jr., aporter2@wooster.edu, (Sharon E. Lynn, slynn@wooster.edu), Box C-2448, The College of Wooster, 1189 Beall Ave., Wooster OH 44691.**

Corticosterone (CORT) is a primary stress hormone in birds. This hormone is often used to assess stress responsiveness using a standardized protocol, a stress series, in which blood samples are collected over a one-hour period of handling. Capture methods for wild birds commonly rely on traplines, but few studies have investigated the effects of these trapping techniques on subsequent CORT responses. This study aims to determine the role of the length of time spent in a trap on the subsequent CORT response in House sparrows (*Passer domesticus*). House Sparrows not taken out of the trap immediately were hypothesized to have an altered CORT response compared to birds removed immediately. Twenty-four House Sparrows were trapped after their molting period using seed-baited Potter traps, and spent 0, 15, or 30 minutes in the trap prior to sampling. Stress series were conducted in which blood samples were taken at 0, 15, 30, 45, 60 minutes after removal from the trap. The zero time point is used to represent baseline CORT levels, while the subsequent time points correspond to increasing CORT levels during the stress response. An ELISA will be used to measure CORT levels.

**10:15 CHARACTERISTICS OF NEURAL PATTERN FORMATION IN GEOMETRIC VISUAL HALLUCINATIONS DRIVEN BY FLICKER, APPARENT MOTION AND FRACTAL (1/F) NOISE. Vincent A. Billock, vince.billock@wpafb.af.mil, General Dynamics, Inc. at the U.S. Air Force Research Laboratory, Suite 200, 5200 Springfield Pike, Dayton OH 45431.**

There are several ways to induce geometric hallucinations in human observers and these phenomena have been linked to self-organized spatiotemporal pattern formation in neural networks in the visual cortex. Study of such systems has been stymied by the random and multistable nature of these illusions. Three different ways to bias self-organization so that the visual system produces stable and predictable hallucinations were used. (1) A CRT was flickered at 12 Hz in a dark room (which produces random hallucinations) with small physical biasing patterns on the monitor, and seven subjects noted the illusory patterns that formed around the biasing pattern. (2) We arranged a large set of icons to cycle on/off in sequence around a square area on an otherwise dark monitor. This produced an illusion of several icons moving around an imaginary square. Two subjects monitored illusory patterns that form in the square. (3) Three subjects viewed fractal ($1/f^a$) spatiotemporal noise through geometric masks and observed illusory patterns that formed in the noise. Exp. 1 & 3 showed pattern opponency - a circular physical pattern produced a reliable fan shaped hallucination and vice versa, for all subjects. The induction of pattern formation by fractal noise in Exp. 3 is consistent with predictions made from stochastic resonance models. For both subjects, Exp. 2 produced a reliable hallucinatory fan, whose rotating blades keep track with the illusory motion of the flickering icons. The ability to produce stable and predictable hallucinations promotes functional imaging, enables parameterization of neural network models, and clarifies the interaction between stimulus generated and spontaneously generated activity in visual cortex.

**10:30 THE VIABILITY OF A MAYAN COMMUNICATION NETWORK VIA PYRAMID STRUCTURES ACROSS THE YUCATAN. Robert M. Cikraji, cikraji@hotmail.com, Kaori Takano, Cuyahoga Community College, 193 E. College, Oberlin Ohio 44074.**

A topographicmetric study of the region between the world heritage site of Chichen Itza and the colonial city of Valladolid was conducted for purpose of ascertaining whether any structures or remnants existed within this intermediate area and within the visual sightlines of the two locations. Archival research produced no documented structures in the region. Using an east-west linear design with cardinal points being Chichen Itza and Coba a radius area of five kilometers was surveyed by field examination. An intact pyramid structure was located approximately twenty-five kilometers from Chichen Itza on direct line with Coba in the very center of the study area. The structure, one of only two at the site, is located on a dried riverbed and in reasonable proximity to the longest sacbe (stone roadway) in Mesoamerica that extends between Coba and Yaxuna. Atop one can see both the pyramid at Chichen Itza and the central church of Valladolid constructed at the previous location of a pyramid and of equal height. One side of the discovered pyramid incorporates part of a natural limestone formation reminiscent of southern Maya of the Tikal region. A carved cauldron appears at the top of this structure. Deposits of carbon and interior wall and ceiling scorching of the upper chambers of the great pyramid of Chichen Itza establish the viability and probability of these structures being utilized as a notification system using fire illumination for military or trade purposes, i.e. the relaying of sea production from the coastal region. The design of the upper chamber and cauldron shaped floor tiles of the pyramid of Chichen Itza supports these conclusions.

**10:45 A SATISFIABILITY APPROACH FOR THE DECONVOLUTION OF FORENSIC DNA MIXTURES. Jason R. Gilder, gilder@bioforensics.com, Forensic Bioinformatics, 2850 Presidential Dr., Suite 150, Fairborn OH 45324.**

In many criminal cases, forensic DNA samples involve mixtures of two or more individuals. It is often difficult to determine which alleles are associated with one individual due to several factors, including allelic sharing and similar contributions of DNA material. A novel methodology is presented for mixture deconvolution that identifies sources of components of mixtures through a mathematically provable formula. Our hypothesis states that the deconvolution method is able to successfully narrow the list of profiles of contributors to a mixture resulting in the inclusion of the correct mixture profile in the generated list. Each locus is treated as a discrete satisfiability problem by enumerating all possible contributor combinations and then creating and testing a set of satisfiability equations for each combination based on peak balance and additivity requirements. For mixtures containing two contributors, the method generates between three and ten satisfiability equations, depending on the number of observed alleles at a given locus. The method was tested using a mixture validation study consisting of five mixture ratios of two individuals typed at nine loci using the Profiler Plus® testing kit. The mixture profiles consist of four loci with four alleles, four loci with three alleles, and one locus with two alleles. The hypothesis was satisfied. The satisfiability approach was able to deconvolve at least two loci in all mixture ratios. The 1:3 ratio was the easiest to separate, where six loci were fully deconvolved. The most difficult ratio was 1:1, where two loci were fully deconvolved. The correct genotype

assignment was included in all deconvolutions across all of the mixture ratios examined.

# Microbiology & Genetics
# 9:00 AM Saturday April 22, 2006
# Issmat Kassem - Presiding
# Science Center Room 106

**9:00 PLOIDY MOSAICISM AND MOLECULAR DIFFERENTIATION AMONG POPULATIONS OF THE SOUTH AMERICAN TWIST-NECKED TURTLE, *PLATEMYS PLATYCEPHALA*. Emily R. Darr[1], darremir@notes.udayton.edu, Ryan M. Huebinger[2], Kelly Williams[1], John W. Bickham[2], [1]Dept of Biology, University of Dayton, 300 College Park, Dayton OH 45469-2320, [2]Dept of Wildlife and Fisheries Sciences, Texas A&M University, College Station TX 77843.**

Diploid-triploid mosaicism or chimerism is a rare birth defect in man and other animals and is found as a natural condition in only one sexually reproducing species, the turtle *Platemys platycephala*. Within this species geographic variation exists for ploidy mosaicism. Turtles from Bolivia are normal diploids with no evidence of mosaicism. Animals from Suriname are highly variable, including, diploids, triploids, and diploid-triploid (and rarely triploid-tetraploid) mosaics. Animals from French Guiana show a higher proportion of triploidy than those from Suriname, being mostly triploid or triploid-tetraploid mosaics, and some individuals with small diploid cell populations. We hypothesized that 1) turtles would group by their geography and 2) turtles would group by ploidy level. This was investigated by performing phylogeny reconstruction using the cytochrome b gene of the mitochondrial DNA (mtDNA). The gene was cloned using Polymerase Chain Reaction (PCR), and sequenced with an internal primer. The 17 sequences (4 French Guiana, 8 Suriname and 5 Bolivia) were analyzed using maximum parsimony (MP), and neighbor joining (NJ) methods. The results find weak bootstrap support (57) for a monophyletic French Guiana clade, mild support (66) for a monophyletic Bolivian clade, and strong support (96) for a monophyletic Suriname clade. The turtles do not group by ploidy level; there is no differentiation between diploids and triploids or mosaic turtles within each population branch in the MP and NJ analyses. The resulting sequences show a relatively high level of divergence among all three populations, each of which is monophyletic.

**9:15 WAS THE SHAWNEE WAR CHIEF BLUE JACKET A CAUCASIAN? Carolyn D. Rowland[1], carrie.rowland@wright.edu, Robert V. Van Trees[2], vntrs1@graphtronics.net, Marc S. Taylor[3], marc.taylor@tai-labs.com, Dan E. Krane[4], dan.krane@wright.edu, [1]Forensic Bioinformatic Services, Inc., 2850 Presidential Drive, Suite 150, Fairborn OH 45324, [2]Historian, Fort Recovery OH, [3]Technical Associates Inc., Ventura CA, [4]Dept of Biological Sciences, Wright State University, Dayton OH.**

The paternally inherited Y chromosome contains the largest nonrecombining block of nucleotides in the human genome (approximately 50 million base pairs) and has much lower levels of polymorphism than any other region of the human genome. As a direct result of the relatively low mutation rate, 0.23%/STR locus/generation in human pedigrees, concordance of male-line relation can be deduced via direct comparison of Y-STR (short tandem repeats) haplotypes. This direct comparison of paternally inherited Y-STR haplotypes was utilized to debunk the centuries old controversial legend of the ancestry of the Shawnee War Chief, Blue Jacket. The historical narrative has depicted Chief Blue Jacket not as Native American Indian but rather a white man of Dutch descent, by the name of Marmaduke Swearingen. The comparison of twelve Y-chromosome polymorphic markers in six purported male-line descendants of Chief Blue Jacket and four purported male-line descendants of Marmaduke Swearingen, eight generations removed in both families, revealed that within each male line, descendants in each of the families shared the same 12 locus Y-STR haplotype. However, the Swearingen haplotype was distinctly different from that of the Blue Jacket male-line descendants, with consistency at only five of the 12 tested loci, therefore, excluding them from an ancestry linked to Chief Blue Jacket.

**9:30 EXPLORING THE POTENTIAL OF *E. COLI* GENES FOR DGGE-BASED BACTERIAL SOURCE TRACKING. Malak A. Esseili, messeil@utnet.utoledo.edu, Von Sigler, von.sigler@utoledo.edu, Issmat I. Kassem, ikassem@utnet.utoledo.edu, University of Toledo, Dept of Earth, Ecological and Environmental Sciences, Laboratory for Microbial Ecology, MS # 604, Toledo OH 43606.**

Current bacterial source tracking (BST) methods are limited in their ability to match polluted sinks with potential sources. The objective of this study was to develop an *E. coli* community fingerprinting method that could differentiate potential sources and match them to polluted sinks. For this purpose, thirteen gene fragments common to *E. coli* were screened for their (i) distribution in 176 environmental *E. coli* isolates, (ii) sensitivity of detection, (iii) fingerprint-based differentiation of *E. coli* communities, and (iv) ability to match sources to contaminated sinks. The distribution and sensitivity of these gene fragments was determined by *E. coli*-specific PCR. Each gene fragment was screened with DGGE for its ability to differentiate (i) artificial *E. coli* communities and (ii) total *E. coli* communities grown from animal fecal material. All the gene fragments were 100% distributed among the *E. coli* isolates except for the *16S* rRNAE1/E2 (95.4%) and *uidA1066* (97.1%) gene fragments. Three fragments of *uidA* (298, 754 and 1939) and the *16S* rRNA gene provided the lowest detection limit ($10^3$ cells/ml) in pure cultures. Cluster analysis of DGGE fingerprints showed that *phoE* and *uidA1939* gene fragments most effectively differentiated (at 80% similarity threshold) *E. coli* communities from different animal sources and indicated the ability of these gene fragments to match pollution sinks to potential sources. In conclusion, when distribution, sensitivity, differentiation and matching sources to sinks were collectively considered, *uidA1939* was the most appropriate target for DGGE-based *E. coli* community fingerprinting and the method showed potential for application in BST studies.

**9:45 ANTIBIOTIC RESISTANCE IN BACTERIA ISOLATED FROM SANDY RIDGE RESERVATION A RESTORED WETLAND IN LORAIN COUNTY, OHIO. Deborah A. Abicht, dabicht@alltel.net, Megan R. Jacobson, peanut5am2003@yahoo.com, Katie D. Hogan, kdhogan77@yahoo.com, Chris T. Smith, ctsmith12@visn.net, (Adam C. Miller, amiller2@lorainccc.edu, Harry W. Kestler, hkestler@lorainccc.edu), Dept. of Biology, Division of Science and Math, Lorain County Community College, 1005 N. Abbe Road, Elyria OH 44050.**

Sandy Ridge Reservation is a 310 acre wetland and wildlife preserve. The wetland is not only valuable because it provides filtration of pollutants, but it also provides habitat for a variety of wildlife. Over 100 species of birds have been observed. Antibiotic resistance has been observed in aquatic samples obtained from Sandy Ridge Reservation since 2003. Bacterial isolates from water samples from 8 different sites at Sandy Ridge were tested for sensitivity to the following antibiotics: Streptomycin, Gentamicin, Bacitracin, Clindamycin, Vancomycin, and Ampicillin. Antibiotic resistance was found in bacteria isolated from all sites tested. In order to determine a possible source of resistance, the migratory Canada geese *(Branta canadensis*) were examined as a possible reservoir. Feces directly obtained from Canada geese were collected from various sites at Sandy Ridge Reservation, and antibiotic-resistant bacteria were isolated from these samples (a total of 32 isolates). The resistance patterns obtained from these samples were comparable to those seen in isolates obtained from nearby aquatic sites. The correlation of the antibiotic pattern observed in the aquatic and feces samples suggest that transfer of resistance may be mediated by the presence of these migratory birds. Additionally, we observed an increase in antibiotic resistance in the bacterial isolates from aquatic samples at Sandy Ridge Reservation from 2004 to 2005. This increase in antibiotic resistance is proportionately related to the increase in *Branta canadensis* population in Northern Ohio during the same time period. Future work will include characterization of mechanisms of antibiotic resistance transfer.

**10:00 DETECTION AND GENOTYPING OF *STAPHYLOCOCCUS AUREUS* IN THE ENVIRONMENT OF NORTH WEST OHIO USING MULTIPLEX- AND REP-PCR. Issmat I. Kassem, ikassem@UTNet.UToledo.Edu, Von Sigler, von.sigler@utoledo.edu, Malak A. Esseili, messeil@UTNet.UToledo.Edu, Damien J. Terry, dterry@utnet.Utoledo.edu, University of Toledo, Dept of Earth, Ecological & Environmental Sciences, Laboratory for Microbial Ecology, MS # 604, Toledo OH 43606.**

The occurrence of environmentally transmitted *Staphylococcus aureus* is well-documented. For example, *S. aureus*-like infections have been observed in bathers in marine and fresh waters and

linked to agricultural biosolids applications. Since understanding the epidemiology of *S. aureus* is important to public health, this study was conducted to develop methodology that can accurately identify *S. aureus* and classify strains to their host origin. Putative *S. aureus* was isolated from class B biosolids (N = 18) and human nasal swabs (N = 25). Donated *S. aureus* isolated from a known source (chicken, N = 18) were also used in the fingerprinting studies (described below). The identity of the isolates was confirmed using a newly-developed multiplex-PCR protocol targeting three *S. aureus*-specific genes (*nuc*, *sa0836* and *femB*). Rep-PCR was used to generate fingerprints of *S. aureus* isolated from environmental samples in an initial attempt to classify the isolates to their host origin. Rep-PCR genotyping showed that isolates from biosolids clustered separately from those isolated from humans and chicken, suggesting that *S. aureus* communities in biosolids either originated from non-human/non-chicken sources, or are regionally constrained. Specifically, Jackknife statistical analysis showed that isolates from biosolids significantly grouped with each other at 94.4% confidence and with human isolates at 5.6% confidence. The results indicate that *S. aureus* is ubiquitous in primary and secondary environments. Furthermore, rep-PCR can effectively classify *S. aureus* isolates to a specific environment, suggesting the potential for developing source-tracking tools that would help monitor *S. aureus* in the environment.

**10:15 SOIL ORGANIC MATTER ANALYSIS AND THE COMPARATIVE ANALYSIS OF GENOMIC DNA FINGERPRINTS OF SOIL BACTERIAL ISOLATES IN THE WILDS, CUMBERLAND, OHIO. Amanda K. Morgan, amorgan@muskingum.edu, (Oluwatoyin Osunsanya, toyin@muskingun.edu, Deepamali Perera, dperera@muskingum.edu), Muskingum College, Dept of Chemistry and Molecular Biology, New Concord OH 43762.**

The objective of this research is to analyze the Soil Organic Matter (SOM) and bacteria isolated from soil samples for uniqueness to a particular location and to compare data from SOM analysis with the microbiological data for any trends and correlations. The soil sampling will be conducted once during each of the four seasons at three distinct sites located in the Wilds in Cumberland, Ohio. The sites are designated reclaimed (south site), restored (butterfly garden), and pristine (butterfly forest). The SOM will be analyzed for oxidizable carbon by means of the Walkley-Black Acid Digestion Method and Loss of Ignition Method and will be extracted via the International Humic Substance Society (IHSS) Method and Environmental Protection Agency (EPA) Soxhlet Extraction. Other EPA methods involving Gas Chromatography and High Performance Liquid Chromatography will be employed for further analysis of the extracts. Bacteria are isolated from soil samples by the Plate Count Method. Genomic DNA fingerprints of two gram negative bacterial isolates will be generated by the rep-PCR amplification method. Statistical tests include the t-test, to determine the difference in organic matter between the three sites as well as the difference in biological content between the three sites. Also, the amount of organic matter and amount of microbes are compared quantitatively with one another. It is expected that the pristine site will have the greatest abundance of bacteria, as well as the greatest amount of SOM, and that the reclaimed site will have the least amount of bacteria and SOM.

**10:30 GLOBAL PROTEOMIC ANALYSIS OF LUNG PROTEINS FROM AQUAPORIN-5 KNOCKOUT MICE BY 2D-SDS-PAGE. Casey A. McDonald, mcdonaca@notes.udayton.edu, Carissa M. Krane, Carissa.Krane@notes.udayton.edu, Dept of Biology, University of Dayton, 300 College Park, Dayton OH 45469-2320.**

Aquaporins are essential plumbing proteins present in various cells which facilitate water transport across certain cell membranes at rates exceeding simple osmosis. Mutations in water specific channels are implicated in various clinical disorders characterized by disruptions in fluid homeostasis. Aquaporin-5(AQP5) is expressed in lung on the apical surface of airway epithelium and alveolar type 1 cells. Mice deficient in AQP5 exhibit normal baseline lung physiology, but manifest an asthmatic phenotype characterized by an increase in magnitude and duration of contraction in response to cholinergic stimulation. Other proteins are hypothesized to compensate for AQP5 to maintain homeostasis under baseline conditions, and knowledge of this differential regulation will lead to further understanding of the asthmatic response. A proteomic approach was taken to identify proteins involved in lung physiology which are differentially regulated in the absence of AQP5. Lung tissue from wildtype (n=6) and knockout (n=5) mice was homogenized, and the cytoplasmic protein fraction was extracted. Two dimensional SDS-PAGE was used to separate proteins by isoelectric point and molecular weight. Approximately 105 to 130 silver-stained spots were present; 4 spots displayed a visible difference in expression between wildtype and knockout. Nano/LC/MS/MS and Mascot Search were used to identify one protein consistently present in only knockout samples as the L, fab fragment from monoclonal anti-arsonate antibody. Protein sequence was confirmed by replicate with ions score 198 where 55 indicates identity or homology ($p<0.05$). In conclusion, analysis of global cytoplasmic protein expression indicates that lung expression is affected by AQP5 deficiency.

**10:45 GDNF PROMOTES PROLIFERATION OF SPERMATOGONIAL CELLS THROUGH SRC-DEPENDENT AND -INDEPENDENT MECHANISMS. Laura Braydich-Stolle[1], braydichgs4@yahoo.com, Meagan Roddy[1], roddymea@notes.udayton.edu, Martin Dym[2], dymm@georgetown.edu, Marie-Claude Hofmann[1], Marie-Claude.Hofmann@notes.udayton.edu, [1]Dept of Biology, University of Dayton, Dayton OH 45469-2320, Dept of Cell Biology, [2]Georgetown University Medical Center, Washington DC.**

Glial cell line neurotrophic factor (GDNF) is essential for neurite outgrowth, neuronal survival, enteric nervous system formation and kidney development. In addition, GDNF is produced by the Sertoli cells of the testis and promotes spermatogonial stem cell proliferation in vivo and in vitro. GDNF signals through a multicomponent receptor system composed of the Ret and GFRa-1 receptors. Proliferation assays and microarray analysis have shown that GDNF induces self-renewal and differentiation in spermatogonial stem cells, and that genes important for these processes are differentially regulated by GDNF. However, the signaling pathways triggered by Ret activation in spermatogonial stem cells have not been elucidated. This study is an attempt to identify GDNF signaling pathways in the mouse using primary cultures of spermatogonial stem cells, a spermatogonial stem cell line and freshly isolated testicular tubules. In all three models, spermatogonia were treated with GDNF in the presence and absence of inhibitors to various signaling pathways. After treatment with GDNF, proteins were isolated from the spermatogonia and used in kinase assays, which showed that when GDNF was present there was an increase in the activity of the p60Src tyrosine kinase. In addition, after treatment, RNA was isolated from spermatogonia and real-time PCR was used to determine the expression of the transcription factor *N-myc,* a known downstream target of GDNF. When GDNF is present *N-myc* expression is increased and when the p60Src tyrosine kinase and the PI3 kinase are inhibited GDNF is unable to promote this increase in expression. Therefore, GDNF promotes spermatogonial stem cell proliferation through activation of the p60Src tyrosine kinase and the PI3K/Akt-dependent pathway to enhance *N-myc* expression. Furthermore, using western blot analysis and siRNA assays, the role of STAT3 in the response to GDNF was assessed. Western blot analysis shows that when GDNF is present STAT3 is phosphorylated at both Tyr705 and Ser727, and this phosphorylation occurs even in the presence of Src inhibitors. Proliferation assays were also performed when STAT3 expression was silenced using siRNA. This assay demonstrated when STAT3 is not produced in spermatogonia; these cells are unable to proliferate, even in the presence of GDNF. Therefore, we found that GDNF activates STAT3 phosphorylation and dimerization in spermatogonia and is important for cell proliferation. Furthermore, activation of STAT3 was also found to be independent of Src kinase activation, indicating that there is an Src dependent and Src independent response to GDNF in spermatogonial stem cells.

# Earth Sciences
## 9:00 AM Saturday April 22, 2006
## Erin Sauer - Presiding
## Science Center Room 66

**9:00 MODFICATIONS OF DRASTIC MAPS FOR FRACTURED TILL. Ann D. Christy[1], christy.14@osu.edu, Julie Weatherington-Rice[1], weathringtn-rice.1@osu.edu, Michael Angle[1], mike.angle@dnr.state.oh.us, [1]The Ohio State University, Dept of Food, Agricultural, and Biological Engineering, Columbus OH 43210, [2]Bennett and Williams Environmental Consultants Inc., Columbus OH, [3]Ohio Dept of Natural Resources, Columbus OH.**

In the mid-1980s, the Ohio Department of Natural Resources Division of Water began a statewide program, producing county-

by-county maps of the potential for ground-water pollution using the DRASTIC mapping methodology. The original DRASTIC methodology needed to be modified to incorporate the effect of fractured glacial till including the concepts of double-block porosity and preferential flow. Glacial till is recognized as a unique vadose zone media, and different quantitative ratings were assigned to the various till lithologies. Several DRASTIC parameters were modified to reflect the nature of underlying parent materials including Net Recharge (R), Impact of the vadose zone media (I), and Soil media (S). Twenty-one field sites within the glaciated portion of Ohio were visited to determine if fractures were present in the soils and the underlying parent materials. In all, 23 of the 95 soils previously identified to have fractures were confirmed in this field study, and four new soils were added to the list: Amanda, Avonburg, Blanchester, and Clermont. All 21 sites were evaluated for their existing DRASTIC settings and, where necessary, new Ground Water Pollution Potential numbers were assigned. Modification of the DRASTIC mapping methodology makes the Ohio Ground Water Pollution Potential mapping program even more accurate and protective of Ohio's ground water supplies as it is applied statewide.

**9:15 USE OF SOIL TEXTURE AND DEPTH ANALYSIS TO PREDICT FRACTURES IN GLACIAL TILLS. Eun Kyoung Kim, kim.916@osu.edu, Ann D. Christy, christy.14@osu.edu, The Ohio State University, Dept of Food, Agricultural, and Biological Engineering, Columbus OH 43210.**

Statistical models and formulas can be useful to explain how fractures are created in glacial tills and may be a useful tool for geologists and field engineers allowing them to anticipate fractures in glacial tills in Ohio and beyond. In the past, predicting the occurrence and development of fractures has been difficult because fracturing has been observed across many geographic areas which are subject to different factors including climate, land use, soil type, and till units. This challenge led to an investigation of available data on soils and tills. Historic data were collected from university theses, journals, and unpublished consultant reports. The data were used to determine the soil texture classes and depths in those glacial tills known to have fractures. Statistical and graphical analysis methods including calculating confidence regions in ternary diagrams and formulating correlations of sand, silt and clay in fractured tills were utilized. When plotted on the USDA soil texture ternary diagram, the data (140 points, covering 52 sites and/or soil pedons) indicate that tills having greater than 10% clay or less than 52% sand are more likely to support fracturing. Based on a 95% hexagonal confidence region plotted on an USDA ternary diagram, tills with less than 55% sand, 20-65% silt, and 5-53% clay would be more likely to form fractures. The texture classes of tills predicted to sustain fracturing were mainly clay, loam, clay loam, silty clay loam and silty clay. Depth of glacial tills having observed fractures ranged from 0.5 to 215 ft.

**9:30 MAPS FROM THE OHIO DIVISION OF GEOLOGICAL SURVEY—NO LONGER JUST ARTWORK FOR THE OFFICE WALL. Douglas L. Shrake, doug.shrake@dnr.state.oh.us, ODNR, Division of Geological Survey, 2045 Morse Rd. C-2, Columbus OH 43229-6693, http://www.ohiodnr.com/geosurvey**

The Ohio Department of Natural Resources, Division of Geological Survey (ODGS) has been mapping and documenting geology in Ohio since 1837. It has compiled, and maintains, an extensive collection of maps depicting Ohio's surface and subsurface geology. Historically, the ODGS collected data, compiled, printed and released a map, and filed the support data at its office. The maps produced are static and users have to travel to the ODGS office to access the map's support data, which is often not in a very user-friendly format. Recently, the ODGS began releasing maps and datasets on interactive CD-ROMs and/or online maps to permit easier access and use by the geologic community. The ODGS now has ten interactive map and data CD-ROMs, three online interactive maps, and numerous downloadable digital GIS layers available. Some of the currently available ODGS digital products include base maps, gravity and magnetic data, bedrock topography and geology, karst features, earthquakes, land subdivisions, oil and gas fields, underground mines, surface elevation, Precambrian structure, glacial, and surficial geology. Given the current availability and future releases of digital data and GIS layers from the ODGS, geologists can electronically assemble the general geological and cultural framework for any area in Ohio. This ability to produce detailed, interactive maps will facilitate the collection of site-specific geologic data in Ohio. Thus, the ODGS's switch from static, printed maps to interactive, digital maps and datasets will greatly enhance the functionality and application of these products to geologic research in Ohio.

**9:45 PALEOMEANDER BEHAVIOR IN THE EARLY COPPER AGE OF THE GREAT HUNGARIAN PLAIN: VESZTÖ, HUNGARY. Erin E. Sauer, sauer.58@osu.edu, The Ohio State University, 200 W. Norwich, Apt. 2K, Columbus OH 43201.**

This project focuses on the interrelationship between meanders of the Feher and Sebes-Körös Rivers and Early Copper Age Settlements located in Southeast Hungary. Done in conjunction with an NFS funded archaeological excavation of two Early Copper Age settlements, the purpose was to determine why almost all Early Copper Age settlements are located along river meanders and how these meanders behaved during the Early Copper Age. It was hypothesized that other channels in the area would be similar to a channel studied in 2004 which was determined to have dried up prior to the Early Copper Age. In 2005, thirty one soil cores were taken by Oakfield auger in and around meanders near the cities of Vesztö, Mezobereny, Körösladany and Zsadany and were analyzed by Munsell color, soil type, moisture, phosphate content, texture and profile. Analysis of the 2005 cores in comparison with cores from 2004 show a striking similarity in soil profile and meander crossection, suggesting that all meanders were dry at the time of Early Copper Age settlements. Thus, location of settlements along these meanders was not due to access to water, but likely, the relative highs in topography created by the channels along otherwise flat ground offered protection from enemies and flooding.

# Aquatic Ecology
# 9:00 AM Saturday April 22, 2006
# Presiding - Tracey Trzebuckowski-Meilander
# Science Center Room 128

**9:00 FRESHWATER DINOFLAGELLATES OF NORTH AMERICA. Susan Carty, scarty@heidelberg.edu, Dept of Biology, Heidelberg College, Tiffin OH 44883.**

A compilation of dinoflagellate records from North America has been assembled for the first time since 1934 when the last publication (Freshwater dinoflagellates of North America) by G.H. Wailes was released. North America is defined as including Canada, the United States (excluding Hawaii), Mexico, Greenland, Central America to Panama, and the islands of the Caribbean (including Bermuda and the Virgin Islands). The goal was to update and organize data from many sources in order to provide researchers with current taxonomy, micrographs, known distributions, and descriptions of all freshwater dinoflagellate species reported from North America. Dinoflagellates are difficult to identify, which explains their under-reporting in the literature. All reports had to be evaluated. The most reliable records are those including accurate original line drawings, the next level are reports by experienced investigators, lastly are reports (usually part of a species list) without any taxonomic references in the literature cited. Published data from 18 countries were examined. I sampled 23 US states and Belize, wrote keys to genera and species, photographed species found, and made original line drawings of species. Some results include distribution maps of 110 species, including 13 species with single, original reports. Many taxonomic problems have been encountered such as (1) to which stage in the life cycle should the name be attached? I use the assimilative stage. (2) should invalidly described species be recognized? Yes, Latin descriptions to be included. (3) what should be done with named species lacking definitive descriptions? (4) is this book the appropriate forum to introduce new genera names?

**9:15 STRUCTURAL AND FUNCTIONAL CHANGES OF TROPICAL AQUATIC MACROINVERTEBRATE COMMUNITIES ASSOCIATED WITH STREAM FLOW WITHDRAWAL ON MAUI, HAWAII. Jennifer A. Schmitz[1], schmit78@msu.edu, Mollie D. McIntosh[1], mcinto57@msu.edu, M. Eric Benbow[2], markbenbow@depauw.edu, Albert J. Burky[3], albert.Burky@notes.udayton.edu, [1]Michigan State University, Dept of Entomology, 243 Natural Science Building, East Lansing MI 48824, [2]DePauw University, Dept of Biology, Greencastle IN 46135, [3]University of Dayton, Dept of Biology, Dayton OH 45469.**

Tropical island streams worldwide are being threatened by existing or proposed dams and diversions that remove freshwater for human use, however little research has addressed the effects of these

structures on aquatic organisms. The main objective of this study was to evaluate the impact of stream diversions, and thus reduced stream flow, on macroinvertebrate communities in tropical mountain streams. Benthic macroinvertebrates were collected from riffle habitats at two sampling locations, above and below a diversion, in two streams on Maui, Hawaii, from June to August 2000. Native and introduced taxa were identified from both locations; with the most dominant taxon being midges (Chironomidae: Diptera) followed by two introduced caddisflies, *Cheumatopsyche analis* (Banks) (Hydropsychidae; Trichoptera) and *Hydroptila potosina* (Buenoa-Soria) (Hydroptilidae; Trichoptera). Although no differences between streams were identified, mean total macroinvertebrate densities in both streams were greater above (ranging from 10,352-13,357 individuals/$m^2$) compared to below (ranging from 5,583-10,461 individuals/$m^2$) the diversion. A native shrimp, *Atoiydia bisulcata*, and beach fly, *Procanace* sp. (Canacidae; Diptera), were either eliminated from or significantly reduced below the diversion (df =12, t=2.12, p>0.05). These results suggest that reduced habitat quality, due to lowered stream flow caused by diversions, limits the macroinvertebrate community that can live and reproduce in these altered stream conditions. This reduction in macroinvertebrate density could also reduce the quantity and quality of available food resources, which could affect the trophic energetics of the downstream systems. Similar changes to macroinvertebrate communities would be expected below dams and diversions of streams in other tropical regions.

**9:30 SMALL BUT MIGHTY – THE ROLE OF BACTERIA IN LAKE ERIE HYPOXIA. Tracey T. Meilander, ttrzebuc@kent.edu, Robert T. Heath, rheath@kent.edu, Dept of Biological Sciences, 256 Cunningham Hall, Kent State University, Kent OH 44242.**

Bacteria are the smallest living organisms in the Lake Erie ecosystem. Despite their small size, bacteria are the most abundant organism in terms of number and biomass. Microbes are responsible for major ecosystem processes such as decomposition and nitrogen fixation. In addition, bacteria deplete Lake Erie's central basin hypolimnion of oxygen creating a "dead zone" for all organisms except bacteria. A comparison was made between the hypolimnic waters of four hypoxic central basin sites and two oxic eastern basin sites during September of 2005. Productivity and phosphate uptake were measured radiometrically using $^3$H-leucine and $^{33}$P, respectively. Bacterial respiration and labile dissolved organic carbon respiration were measured by a difference in oxygen concentration over periods of five and thirty days, respectively. Bacterial cells were observed under epifluorescence microscopy and sized using image analysis software. Bacterial productivity and growth efficiency were significantly greater (ANOVA, $p<0.05$) in the central basin (BP max = $2.89 \times 10^{-3} \pm 8.27 \times 10^{-5}$, BGE max = 65.6 ± 22.3%) relative to the eastern basin (max =$1.01 \times 10^{-4} \pm 3.62 \times 10^{-6}$, BGE max = 3.8 ± 0.2%), despite no differences in bacterial number, cellular biovolume, total biovolume, and respiration. No significant differences (ANOVA, $p>0.05$) in phosphate uptake and respiration of labile dissolved organic carbon were observed. These results expand and confirm similar conclusions observed in 2004. Bacteria grow to a greater extent and more efficiently in central basin hypoxic sites. High bacterial activity may contribute to "dead zone" formation in the central basin. NOAA/GLERL (R/ER-70) funded this investigation as part of the International Field Year of Lake Erie study.

**9:45 POPULATION-BASED MOLECULAR-TRACKING OF *E. COLI* AT LAKE ERIE BEACH, NORTHWEST OHIO. Xixi Huang, xixi.huang@utoledo.edu, Von Sigler, von.sigler@utoledo.edu, Laboratory for Microbial Ecology, University of Toledo, 2801 West Bancroft MS 604, Toledo OH 43606.**

Lake Erie Beach (Oregon, OH) is often under swimming advisories due to fecal coliform pollution presumed to originate in Berger ditch, a nearby tributary to Lake Erie. Previous study indicated that *E. coli* densities in water samples collected along Lake Erie Beach were highly variable, but significantly higher in water collected at the east end of the beach, adjacent to Berger ditch, (367 ± 66 CFU 100 $ml^{-1}$) as compared to the west end (132 ± 126 CFU 100 ml-1). Based on these results, the current study was initiated to determine the potential sources of bacterial pollution in Lake Erie. Between October 2005 and January 2006, *E. coli* were enumerated by membrane filtration and incubation on Rapid *E. coli* II media in water samples collected from three sites along Lake Erie Beach and Berger ditch. *E. coli* densities were 162 ± 8.6 CFU 100 $ml^{-1}$ and 153 ± 12.7 CFU 100 $ml^{-1}$ in water collected from the east and west ends of the beach, respectively. The DNA of the $\beta$-glucuronidase gene (*uidA*) was PCR amplified and the *E. coli* community structure was assessed by denaturing gradient gel electrophoresis (DGGE). Community fingerprinting indicated similarity in community structure existed between *E. coli* populations sampled from the ditch and beach. We conclude that Berger ditch contributed to the high *E. coli* counts observed at Lake Erie Beach.

**10:00 *HEXAGENIA* MAYFLY NYMPH BIOTURBATION AND ITS POTENTIAL EFFECTS ON INTERNAL NUTRIENT LOADING IN LAKE ERIE. Douglas D. Kane[1], kane.45@osu.edu, Grace M. Kilbane[1], gracek77@hotmail.com, Jason A. Porter[2], japh@lehigh.edu, David A. Culver[1], culver.3@osu.edu, [1]Dept of Evolution, Ecology, and Organismal Biology, The Ohio State University, 1527 Museum of Biological Diversity, 1315 Kinnear Rd., Columbus OH 43212, [2]Earth and Environmental Sciences, Lehigh University, Bethlehem PA.**

*Hexagenia* spp. mayfly nymphs are known bioturbators of lake sediments, causing transport of sediment and associated nutrients (i.e., phosphorus) to the water column. This potential for nutrient transport combined with recent increases in *Hexagenia* populations in Lake Erie suggest that mayfly nymphs may have a significant impact on internal nutrient loading in Lake Erie. The contribution of burrowing mayflies (*Hexagenia* spp.) to water column nutrient concentrations was investigated using microcosms (N=9). 2+ L tanks containing 10 mayflies, water, and sediment (N=3) were compared with tanks containing water and sediment (N=3) and water only (N=3) from Lake Erie to determine the effect of *Hexagenia* on water column nutrient concentrations. Percent transmittance and dissolved oxygen levels, as well as nitrate, soluble reactive phosphorus (SRP), and total reactive phosphorus (TRP) concentrations were measured every 6 h over a 24 h period. Differences in nitrate, SRP, and TRP concentrations were not statistically significant (repeated measures ANOVA) among treatments. However, microcosms containing *Hexagenia* had lower percent transmittance, lower dissolved oxygen, and showed increased mean concentrations of TRP (47.7 and 67.9 μg/L greater) and SRP (16.2 and 25.1 μg/L greater) when compared to sediment and water controls. Ranges of TRP values found in this experiment (54.2-107.5 μg/L) are 3-6 times greater than the average total phosphorus (TP) concentrations reported in the offshore waters of the western basin of Lake Erie between 1989-1993 (17.5 μg/L). These findings show the potential for *Hexagenia* populations to affect phosphorus loadings to the water column through bioturbation of lake sediments.

**10:15 EVIDENCE FOR DIEL HORIZONTAL MIGRATION (DHM) OF CRUSTACEAN ZOOPLANKTON IN THE WESTERN BASIN OF LAKE ERIE. Hong Nguyen[1], nguyen.642@osu.edu, Douglas D. Kane[1,2], kane.45@osu.edu, [1]F.T. Stone Laboratory, P.O. Box 119, Put-In-Bay OH 43456, [2]Dept of Evolution, Ecology, and Organismal Biology, The Ohio State University, Columbus OH.**

The aim of this study was to determine if diel horizontal migration (DHM) of crustacean zooplankton occurs in the western basin of Lake Erie, focusing specifically on how predation (invertebrate and fish) affected zooplankton DHM. A 24-hour period (diel) study was conducted with samples being taken at midnight, before sunrise, midday, and before sunset at three sites: 2 nearshore and 1 offshore site on 6 dates during the summer of 2005. We hypothesized that there would be more crustacean zooplankton in the nearshore sites than the offshore site during the daytime because of high predation pressure in the offshore. Contrastingly, we hypothesized there would be more crustacean zooplankton in the offshore during the nighttime due to reduced predation pressure. Zooplankton samples (N=78) were collected using a metered zooplankton net and preserved using a 4% sugar formaldehyde solution and then enumerated under a dissecting microscope with densities calculated using dilution techniques and flow meter data. We determined the densities of three taxa: cladocerans, cyclopoid copepods, and calanoid copepods, and the total of all these taxa combined. Zooplankton density differed by taxon ($p<0.001$) and site was also marginally significant ($p=0.057$) (MANOVA with taxon, site, time of day and interactions among factors). Further, there was a significant difference ($p=0.004$) in cladoceran density by site (2-way ANOVA with time of day, site, and interaction between factors). Results indicated that zooplankton in western Lake Erie exhibit DHM, but not as predicted, with increases in nearshore crustacean zooplankton abundance (#/L) (45.95+22.19 and 26.13+9.88), compared to offshore abundance (7.24+ 0.92) only before sunset. There were more invertebrate and fish predators at the nearshore sites than offshore and most of the predators were found at night. Biotic factors, such as predators, and abiotic factors, such as turbulence, were likely responsible for the zooplankton DHM pattern that was found.

**10:30 AGE, CHARACTERIZATION, AND DISTRIBUTION OF *SPIROBRANCHUS GIGANTEUS* (CLASS POLYCHAETA, FAMILY SERPULIDAE) ON PARAISO REEF, COZUMEL, MEXICO. Stephanie E. Petitjean, spetitje@capital.edu, Amy E. Myers, amyers@capital.edu, Capital University, Dept. of Biology, 1 College and Main, Columbus OH 43209.**

Christmas Tree Worms, *Spirobranchus giganteus*, burrow into a variety of coral species found in warm water oceans, including the near shore fringe reef, Paraiso Reef. Data on age, color, vertical or perpendicular attachment, response to fluid wave stimulus, coral species occupied, and distribution were collected for 111 *S. giganteus* specimens on Paraiso Reef, Nationale Marine Parque, Cozumel, Mexico, 2-13 January 2005. It was hypothesized that *S. giganteus* would be distributed randomly on coral heads of all species if they had no distinct preference of coral species on which to settle and grow. Age was judged by diameter of holes in the coral heads, based on prior studies in Japan; ages ranged from 20 months to 26 years. *Acropora palmata*, an abundant species of Elkhorn coral noted in Belize studies, was notably absent and this may have required *S. giganteus* to colonize non-preferred species in the study area. The random sample of 111 *S. giganteus* were distributed on eight different types of coral heads: *Montastraea annularis , M. cavernosa, Porites astreoides, Siderasterea siderea, Agaricia agaricia, Eusmillia fastigiata, Diploria labyrithformis*, and *Millepora complanata*. A Chi-square goodness of fit test $\times^2$ (4, n=106) = 18.73, pd"0.05 showed a significant coral host preference for *Eusmillia fastigiata*. No preference was shown by *S. giganteus* for *Montastraea annularis, M. cavernosa,* or *Siderasterea siderea,* or the less abundant *Porites astreoides* when compared to occurrence of these coral species. A Chi-square test of independence $\times^2$ (10, n=11) = 31.122, p=0.001 revealed a significant relationship between worm color and location (shallows, reef, or lagoon.) A one-way ANOVA for independent samples F(5, n=105) = 5.697, p=0.000 revealed a significant preference for the color red in shallower water (1.52-3.66m.)

# Plant, Systematics & Ecology 9:00 AM Saturday April 22, 2006 Mark Headings - Presiding Science Center Room 146

**9:00 NEST-SITE FIDELITY IN GRASSLAND BIRDS: 5 YEARS OF DATA FROM THE WILDS. Danny J. Ingold, ingold@muskingum.edu, John M. Treasure, johnt@muskingum.edu, Biology Dept, Muskingum College, New Concord OH 43762.**

Reclaimed surface mines in the eastern U.S. provide suitable nesting and wintering habitat for several grassland bird species. The extent to which individuals return to previous nest and over-wintering sites, may serve as a useful indicator of the quality of such disturbed habitats for declining bird populations. From May through mid-July 2005 we observed returning color-banded savannah sparrows (*Passerculus sandwichensis*), grasshopper sparrows (*Ammodramus savannarum*), Henslow's sparrows (*A. henslowii*) and bobolinks (*Dolichonyx oryzivorus*) that were banded during the summers of 2000-2004 (n = 520 total). We also considered return data from each of the previous four breeding seasons (n = 69 total). Thirty-one percent of savannah sparrows (34/109) returned to nest in the same 90 x 180 meter rectangular plot, or area between plots, during one or more years following their banding. Twenty five percent of bobolinks (7/28) banded in 2000-2004 returned during one or more subsequent years, while 22% of grasshopper sparrows (45/207) and 10% of Henslow's sparrows (8/79) returned. When only birds banded as adults were considered, versus hatching-year individuals, the return rate for each species increased (31% to 42% in savannah sparrows; 25% to 27% in bobolinks; 22% to 24% in grasshopper sparrows; 10% to 12% in Henslow's sparrows). Conversely, the return rates of birds banded during their hatching year to their natal areas was low (6% in savannah sparrows; 4% in grasshopper sparrows; 0% in bobolinks and Henslow's sparrows). The frequency with which individuals of each species returned to plots that had been mowed in April of each year, did not differ significantly from the return rate of individuals to unmowed plots (40% vs. 27% in savannah sparrows; 27% vs. 19% in grasshopper sparrows; 0% vs. 11% in Henslow's sparrows; 27% vs. 29% in bobolinks).

**9:15 EXTRAFLORAL NECTARIES ON COWPEA, *VIGNA UNGUICULATA*, GENOTYPE CALIFORNIA BLACKEYE NO. 5 AND THEIR ATTRACTION TO NECTAR SEEKING INSECTS. Mark E. Headings[1], headings.1@osu.edu, Leslie Morris[2], morris.508@osu.edu, [1]The Ohio State University Agricultural Technical Institute, 1328 Dover Rd, Wooster OH 44691, [2]USDA-ARS at The OSU Ohio Agricultural Research and Development Center.**

Floral nectar serves as an attractant to pollinating insects; however, selected plants also produce extrafloral nectar which is attractive to certain insects. The objective of this field study was to determine the presence or absence of extrafloral nectaries on a number of different types of beans. These beans were planted in field conditions, and those observed having no extrafloral nectaries were: Top Crop, Golden Wax, Royal Burgundy, Pencil Pod, Lima-Dixie Butterpea, Roma II, Lima-Henderson Baby Bush, Lima-Fordhook 242 Bush, Garden-Bush Romano 26 Italian, Garden-Bush Blue Lake 274, Garden Tendergreen Improved Bush and Garden-Contender Bush. Cowpea, *Vigna unguiculata L. Walp*, genotype California No. 5 was observed to have well-defined extrafloral nectaries and thus became the focus of this investigation. The extrafloral nectaries on this plant are distinctly raised structures on the stems and are located between flowers developing on opposite sides of the stem. Similar extrafloral nectaries are present on mung and adzuki beans. Twenty-six photographs of extrafloral nectaries on cowpeas were produced using a Hitachi S-3500 variable pressure scanning electron microscope. Each of these nectaries typically have two to eight openings in slightly depressed areas on the outer surface through which nectar exudes. A variety of insect species actively visit these extrafloral nectaries, including the multicolored Asian lady beetle, *Harmonia axyridis*, the small honey ant, *Prenolepis impairis*, and a number of other species of Hymenoptera and Diptera. It has not been determined whether the plant benefits from these insect visits; however, the insects utilize the nectar as a food source.

**9:30 IMPACT OF THE INVASIVE SPECIES, LONICERA MAACKII. ON SOIL MICROBIAL COMMUNITIES IN RIPARIAN FORESTS. Rebecca Fauver, fauver.5@osu.edu, (Virginie Bouchard, bouchard.8@osu.edu), Ohio State University, 2021 Coffey Rd, Columbus OH 43210.**

One of the most problematic invasive plants in forests of the eastern US is Honeysuckle *Lonicera maackii* [Rupr.] Herder. This species is known to have negative impact on native plant communities, but little is known about its impact on soil processes. The catabolic response profile (CRP) method was used to assess whether *maackii* has any effect on the soil functional microbial diversity of invaded riparian sites. With this method, a microbial functional diversity is determined by measuring the catabolic response of a soil microbial community to specific carbon-based substrates. Soils were collected from three riparian forests in Franklin County, Ohio that have been invaded by *maackii*. In each forest, 16 samples were taken from plots underneath, and plots clear of *maackii*. The hypothesis is that the soil microbial community under the *maackii* will have lower species diversity than that of the control plots. The CRP of the soil community was measured by adding 2-mL of individual 24 substrates of 5 major groups of organic substrates (amino acids, amines and amides, aromatics, carbohydrates, and carboxylic acids) to 1 g (dry weight equivalent) of soil within a serum bottle. A soil sample also was prepared with 2 ml of deionized water to measure the base catabolism of the microbial community. The bottles were tightly sealed and incubated for 4 h at room temperature. The bottles were shaken after substrate addition, after two hours, and finally before collection of a headspace sample. The $CO_2$ in the headspace from each bottle was analyzed with a LI-COR $CO_2$ analyzer. Diversity is measured by richness and evenness using the Simpson-Yule index ($E = 1/Sp_i^2$). Initial analysis showed little to no differences between the invaded and non-invaded soil samples.

**9:45 SEED PRODUCTION OF FOREST-GROWN AMERICAN CHESTNUT *CASTANEA DENTATA* IN WEST SALEM, WISCONSIN. Keith E. Gilland, Gillanke@muohio.edu, (Carolyn Howes Keiffer, Keiffech@muohio.edu), Dept of Botany, Miami University, Oxford OH 45013.**

There are few records concerning pre-blight seed production of forest grown American chestnut (*Castanea dentata*). As blight resistant American chestnut becomes available, many wildlife and conservation groups are interested in reintroducing the tree as an annual food source. As part of a long term ecological study involving a disjunct population of American chestnut a seed production study was performed in the fall of 2005. Ten large diameter (>23cm) fruiting American chestnuts were measured for height, crown spread, crown volume and dbh. Trees selected were forest-grown in the West Salem stand with intact canopies and no apparent blight damage. Seed production was determined by counting the large

opened burs beneath the tree canopy and any burs remaining on the tree with three seeds produced per bur. One half of the total canopy area was sampled plus an additional meter beyond the canopy edge. This method is reliable because of the size and structure of chestnut burs which makes them unlikely to be removed from beneath the tree. This method requires no estimation for losses due to predation or trap damage as found in traditional seed trap experiments. The mean seed weight was 2.65g resulting in a yield of 142g/m$^2$ (1265 lbs/acre). Comparison of seed production with tree morphometrics will also be determined. Additionally, *C. dentata* seed production will be compared to other nut producing trees including oak and hickory. These results should provide valuable insight into the reproductive potential of *C. dentata* in a forest ecosystem.

**10:00 IDENTIFICATION AND AMPLIFICATION OF TWO LOW-COPY NUCLEAR GENE REGIONS FOR ASSESSING BIPARENTAL INHERITENCE IN MOONWORTS (*BOTRYCHIUM* S. S.). Madhuvanti Patil, patil_m@denison.edu, (Warren D. Hauk, hauk@denison.edu), Slayter Box# 1947, Denison University, Granville OH 43023.**

Building a phylogeny of the moonworts (*Botrychium* s.s.) is problematic because about 60% of moonwort species are allopolyploid. Allopolyploids contain genotypes reflecting at least two different phylogenetic histories because they are derived from hybridization events between two species, making their placement in the phylogeny difficult. Low-copy nuclear genes are promising molecular tools for classification and phylogeny construction because their biparental inheritance can reveal the identity of both parents of allopolyploids. However, no primers are available for the amplification of low-copy nuclear genes in moonworts. Out of the five sets of degenerate primers tested for amplification, two low-copy nuclear gene region primers: *G3pdh* (glyceraldehyde 3-phosphate dehydrogenase) and *Cam* (calmodulin) worked in moonworts. The goal of this study was to make species-specific primers for moonworts from the amplified and cloned *G3pdh* and *Cam* fragments. *G3pdh* and *Cam* gene fragments were amplified from single accessions of each of the following moonwort species; *B. lanceolatum*, *B. lunaria*, *B. matricariifolium*, *B. minganense*, *B. pinnatum*, and *B. simplex*. Gel-isolation and cloning of amplified products were conducted and the cloned inserts were visualized by direct PCR.

**10:15 ANALYSIS OF GENETIC VARIATION IN *CHEIROGLOSSA PALMATA* (OPHIOGLOSSACEAE) USING ISSR-PCR: IMPLICATIONS FOR CONSERVATION. Meagan M. Coneybeer, coneyb_m@denison.edu, (Warren D. Hauk, hauk@denison.edu), Denison University, Slayter Box 540, Granville OH 43023.**

*Cheiroglossa palmata* (L.) C. Presl is the sole species in the genus *Cheiroglossa* in the fern family Ophioglossaceae. Although the species is found in tropical Latin America, Vietnam, Madagascar, Seychelles and Reunion, its range in North America is restricted to peninsular Florida. The Florida populations of *C. palmata* are listed as imperiled and are unique because they survive in a habitat considered marginal for the species. Inter-simple sequence repeat-polymerase chain reaction (ISSR-PCR) was implemented to analyze variation among the Florida populations of *C. palmata*. To amplify specific DNA sequences, the technique cycles a mixture of complementary single-stranded DNA primers, double stranded DNA, polymerases, and buffers through temperature-controlled steps. The PCR product is separated on an electrophoresis gel and the banding patterns are analyzed to determine variation. The objectives of the study were to: 1) evaluate the incidence of clonal reproduction, 2) assess the distribution of genetic variation, and 3) provide genetic data for the development of a conservation plan for *C. palmata* in Florida. Preliminary comparison of loci amplified in *C. palmata*, *Ophioglossum petiolatum*, and *O. californicum* suggested that fewer loci were produced in *Cheiroglossa* than *Ophioglossum*. However, the bands produced in *C. palmata* are unique to the genus and not present across the Ophioglossaceae. Initial comparison of all *C. palmata* individuals using a single ISSR primer suggested that there is low genetic variation among individuals and across populations, but data from additional primers will be collected in order to determine the extent of genetic variation present in *C. palmata.*

**10:30 THE EFFECT OF DIFFERENT CAPPING REGIMES ON THE MICROBIAL COMMUNITIES IN CONTAMINATED SEDIMENTS. Qi Wang[1], wangqi_19@yahoo.com, Issmat I. Kassem[2], ismatkassem@hotmail.com, Von Sigler[2], von.sigler@utoledo.edu, Cyndee Gruden[1], cyndee.gruden@utoledo.edu, University of Toledo, [1]Dept of Civil Engineering, M. S. 307, 3024 NH, Toledo OH 43606, [2]Dept of Earth, Ecological and Environmental Sciences, The Laboratory for Microbial Ecology.**

Capping is used to sequester contaminants in sediments to mitigate pollution of overlying surface waters. The effect of cap material on the microbial communities (potential contaminant degraders) in underlying sediments is not well characterized. This study determined the impact of capping and cap-type (sand vs. synthetic aggregates) on the number, activity and community structure of microbial communities inhabiting sediments collected from the Anacostia River (WA). Total and active bacterial cells were enumerated by direct counting methods using fluorescent microscopy, while activity was estimated using enzymatic assays. The structure of the microbial communities was evaluated by generating DNA fingerprints. The microbial communities in sand-capped sediments showed highest proportion of active cells (32 %) as compared to uncapped sediment (26 %). The microbial communities in uncapped sediments exhibited the lowest activity, while those in the sand capped sediments showed the highest activity (104 µg vs. 139 µg fluorescein g$^{-1}$ dry sediment h$^{-1}$). The metabolic response (capacity of growth on different carbon substrates) for the communities in the uncapped sediments was the highest with (0.957 OD, optical density) using 19 carbon substrates out of 30 available in assay, while the lowest metabolic response (0.471 OD) using 11 substrates was observed for the communities under the synthetic aggregates cap. DNA fingerprinting revealed that the cap type altered the structure of the microbial communities changing its indigenous composition. In conclusion, the activity and structure of the microbial community were significantly (t-test) positively or negatively affected based on the cap-type applied to the sediment.

# Engineering
# 9:00 AM Saturday April 22, 2006
# Hamid Rismani-Yazdi - Presiding
# Science Center Room 150

**9:00 DESIGN AND FABRICATION OF NOVEL METAL/DIELECTRIC PERIODIC STRUCTURES FOR OPTICAL APPLICATIONS. Cijy E. Sunny, sunnycie@notes.udayton.edu, Andrew M. Sarangan, sarangan@udayton.edu, University of Dayton, Electro-Optics Grad Program, Dayton OH 45469-0245.**

A novel periodic thin film structure was produced utilizing metals and dielectrics. Conventional multilayer structures were constructed using dielectric materials of differing indices of refraction in a periodic (or quasi periodic) fashion. Structures with comparable performance can be realized by using metals and dielectric instead of all-dielectrics. The large index contrast between metals and dielectrics gives rise to a very broad reflection spectra (and correspondingly wide stop bands) using substantially fewer layers compared to all dielectric periodic structures. Furthermore, despite the high absorption coefficient of the metal films, a high transmission coefficient could be achieved by carefully placing the metal films at the field minima of the resonant wave. The design and simulation were performed using a complex formulation of the transfer matrix method (TMM). The structure consists of four pairs of $SiO_2$ and Ag films on a glass substrate. Simulations predict around 40% transmission within the visible range (0.4µm-0.7µm), and strong attenuation outside this window. The films were deposited using an RF magnetron sputter deposition system and the transmission characteristics of the multi-layer stacks were examined using a spectrophotometer. The measurement results showed a transmission of around 60% in the visible region (0.4µm-0.7µm). Five different stacks were fabricated under different sputter conditions like process gas pressure, RF power and thickness of the films deposited. It was concluded that the performance of theses stacks depended on the tooling factor, thermal conductivity, process gas pressure and sputter chamber conditions. Also Ag films thicker than 100A produced smoother films with less roughness which led to more coherent reflection and transmission.

**9:15 PATH PLANNING IN A THREE DIMENSIONAL ENVIRONMENT. Shreecharan Kanchanavally, kanchasc@notes.udayton.edu, Raúl Ordóñez, ordonez@ieee.org, Dept of Electrical and Computer Engineering, University of Dayton, Dayton OH 45469-0226.**

The concept of autonomous cooperative vehicle has recently found applications in many fields, from managing a team of mobile agents

for fire fighting or military mission, to coordinating a group of rovers to explore an unknown environment or perform search and rescue scenarios. A key problem in the field of mobile robotics is navigation through an unknown environment. Navigation or path planning is to determine how to move an object from its original location and orientation to a goal configuration while avoiding collision with obstacles. A control scheme is proposed via feedback linearization for three dimensional cooperative path planning of a class of interconnected systems in general and Unmanned Aerial Vehicles (UAVs) in particular. Also proposed is a task assignment algorithm for dealing with multiple UAV and multiple target scenarios. The initial simulation results show that with this control scheme along with a distance varied repulsive profile between UAVs and electromagnetic repulsive profile between UAV and obstacle, allows UAVs to converge to an invariant set of a known target location without colliding with other vehicles and obstacles.

**9:30 HARVESTING ELECTRICITY FROM CELLULOSE USING RUMEN MICROBES IN A MICROBIAL FUEL CELL. Hamid Rismani-Yazdi, rismani-yazdi.1@osu.edu, Ann D. Christy, christy.14@osu.edu, The Ohio State University, Dept of Food, Agricultural and Biological Engineering, Columbus OH 43210.**

Microbial fuel cells are bio-electro-chemical reactors in which microorganisms mediate the direct conversion of chemical energy stored in organic compounds into small amounts of electrical energy. The purpose of this study was to test rumen microorganisms as electrochemically active biocatalysts and cellulose as an electron donor in microbial fuel cells. Each two-compartment fuel cell was constructed of two glass cylinders (400mL working volume each) connected by a tubular glass bridge (30mm diameter). A proton-exchange membrane was clamped across the glass bridge to separate the contents of the anode and cathode compartments. Graphite plates (84cm2) were used as electrodes in both chambers and connected via an electrical wire and 1000ohm resistor. The anode chamber of the fuel cell was inoculated with a consortia of rumen microorganisms and cellulose as the sole substrate. No external redox mediators were used, and anaerobic conditions were maintained in the anodic compartment. The cathode compartment contained potasssium ferrocyanide / buffer solution flushed continuously with air. Two microbial fuel cells were tested in two trials, with the results showing an average 40mW/m2 power density and a maximum 55.3mW·m2. Voltage output ranged from 250mV to 590mV. Electricity generation involved attached and suspended microorganisms. Further work is needed to identify the specific active microbial species. This study adds rumen microbes to the list of microorganisms shown to produce electricity, and expands the range of suitable substrates to include cellulose, a most abundant plant biomass component readily available as a waste material in many parts of the world.

**9:45 SIMULATION OF PARAMETRIC DOWN-CONVERSION IN $ZnGeP_2$. Anup Pandey, pandeyar@notes.udayton.edu, Joseph W. Haus, joseph.haus@notes.udayton.edu, Peter P. Powers, peter.powers@notes.udayton.edu, Electro-Optics Program, University of Dayton, Dayton OH 45469-0245.**

Intense laser sources have been available for several years, but their emission wavelength is usually fixed to a single wavelength or tunable over a narrow band of wavelengths. Crystals exhibiting strong nonlinear responses have been grown to make widely tunable sources of coherent light using optical parametric down-conversion, i.e. mixing two wavelengths to generate a third (longer) wavelength. Efficient parametric sources are readily available in the range from about 1.5 to 3.2 μm. It is a challenge to generate light at longer wavelengths. $ZnGeP_2$ (ZGP) crystals have a large optical nonlinearity (75 pm/V) and they are transparent over the range of wavelengths in the mid–infrared from 0.8 to 12 μm, which makes them suitable sources of tunable infrared radiation in the 5 to 12 μm range. A simulation method was developed to study the optical beam propagation in ZGP in order to elucidate its optical parametric conversion efficiency in the mid-infrared wavelength range. A comparison was made between this simulation and recently generated wavelengths around 5 μm in ZGP through the down-conversion process by the experimentalists [1]. The basic equations for the optical propagation in the problem involve three wavelengths, $\lambda_s$, $\lambda_i$ and $\lambda_p$, called the signal- , idler- and pump-wavelengths, respectively. The equations used in the simulation for the three corresponding electric fields are

$$\frac{\partial E_S}{\partial z} = \frac{i}{2k_s}\nabla_\perp^2 E_S - \tan\rho_s \frac{\partial E_S}{\partial x} + i\frac{\omega_s \chi^{(2)}}{n_s c} E_P E_I^* e^{i\Delta kz}$$

$$\frac{\partial E_I}{\partial z} = \frac{i}{2k_I}\nabla_\perp^2 E_I - \tan\rho_I \frac{\partial E_I}{\partial x} + i\frac{\omega_I \chi^{(2)}}{n_I c} E_P E_S^* e^{i\Delta kz}$$

$$\frac{\partial E_P}{\partial z} = \frac{i}{2k_P}\nabla_\perp^2 E_P - \tan\rho_P \frac{\partial E_P}{\partial x} + i\frac{\omega_P \chi^{(2)}}{n_P c} E_S E_I e^{-i\Delta kz}$$

The first term on the right hand side is the diffraction term and the wavenumber appearing in the denominator is related to the wavelength by $k_\alpha = 2\pi/\lambda_\alpha$ for $\alpha$= s, i, or p. The next term with tan $\rho_\alpha$ is the beam walkoff in the crystal; the third term has the optical nonlinearity coefficient $\chi^{(2)}$ for ZGP, the index of the wave $n_\alpha$ the angular frequency $\omega_\alpha$, and the phase mismatch $\Delta k$. These equations were solved numerically using a split step spectral method. Input Gaussian beams having a total input energy per pulse of 0.8 mJ of signal and idler wavelengths 2610 nm and 1760 nm are used. The conversion efficiency to the 5404 nm wavelength is 8.71%. Experimentally the reported efficiency is 5.2 % [1]. The discrepancy could be in the lack of optimization of the input beam and the quality of the crystal. For a second crystal added behind the first and oriented for optimized conversion of 2610 nm and 5404 nm to produce 5048 nm, we find 21 % conversion efficiency.

**10:00 DESIGN AND FABRICATION OF SILICON MICRO-PHOTONIC DEVICES. Lirong Sun, sunliroz@notes.udayton.edu, Andrew Sarangan, sarangan@udayton.edu, University of Dayton, 300 College Park, Dayton OH 45469-0245.**

One of the limiting factors of the quantum efficiency of infrared focal plane arrays is the detector fill factor. This is the percent of light that falls on the useful part of the detector compared to the total incident light. A micro-photonic structure with an inverted grooved notch was designed and fabricated to increase the detector fill factor. The groove deflects light away from the areas between the detectors gaps and directs them towards the central detector material. Compared to spherical microlenses, the grooves can be arranged to accommodate virtually any detector geometry, and are much simpler to fabricate. The optical design was carried out using the Finite-Difference Beam Propagation Method (BPM), and refined using the Finite-Difference Time Domain (FDTD) Method. Simulations indicate that the sidewall angle of the groove must be greater than 75-degrees in order to redirect the light into the detector. The fabrication was performed in a class-100 cleanroom on a planar silicon substrate using the fluorocarbon inductively-coupled plasma (ICP) reactive-ion-etching technique. This process utilizes the competition between the deposition rate of the polymer byproducts and the etch rate of the silicon to achieve side wall angles as high as 85-degrees. Optimum conditions were achieved at a bias voltage of 300 volts, inductive power of 800 watts, and a substrate temperature of 40 degrees Celsius at a process pressure of 20mTorr.

**10:15 ROOM TEMPERATURE TERAHERTZ DETECTION. Jason M. Kramb, krambjam@notes.udayton.edu, Peter Powers, Peter.Powers@notes.udayton.edu, The University of Dayton, Dept of Physics, Science Center 111, 300 College Park, Dayton OH 45469.**

A tunable terahertz (THz) source based on difference frequency generation (DFG) capable of operating from 1.5 to 4.5 THz was previously developed. In the past, a liquid helium cooled bolometer was used to measure the THz radiation, but is difficult and expensive to work with. The goal of this project is to replace the bolometer with a room temperature detection scheme based on nonlinear optical frequency upconversion in GaSe. In this process, the THz frequencies are mixed with a near-infrared (NIR) pump laser in a GaSe crystal to generate a sum-frequency signal in the NIR which can then be detected with a standard silicon photo-detector. The pump and upconverted frequencies are close in wavelength, however the procedure used allows for separating them. Firstly the two wavelengths are orthogonally polarized so that we can use a polarizer to pass only the upconverted beam. Secondly we are also using a noncollinear geometry so that we can spatially separate the two beams. Finally, we have the capability to scale the pump laser energy to high levels to allow for significant conversion efficiency.

**10:30 ENGINEERING A MOLECULAR FORCE IMBALANCE TO DISPERSE CLAY IN PMR POLYIMIDE NANOCOMPOSITES. Michael J. Gintert[1], gintert@uakron.edu, Sadhan C. Jana[1], janas@uakron.edu, Sandi G. Miller[2], sandi.g.miller@nasa.gov, [1]The University of**

**Akron, Dept of Polymer Engineering, Akron OH 44325-0301, [2]NASA Glenn Research Center, Cleveland OH 44135.**

Fully exfoliated PMR thermoset polyimide/clay nanocomposites are developed for high-performance aerospace applications such as engine casings and cryogenic storage tanks to offer increased heat distortion temperature, improved thermo-oxidative stability, increased stiffness, and reduced permeability of hydrogen and oxygen. Full exfoliation of clay cannot be achieved by current PMR composite manufacturing technology. This study investigates a novel composite manufacturing method whereby full clay exfoliation can be achieved. In this method, clay galleries are intercalated with small fractions of PMR-5 (MW=500) before combining into PMR-15 (MW=1500) resin so that the difference in intra- vs. extra-gallery crosslink density results in an imbalance of intra-gallery elastic forces (G') to extra-gallery viscous forces ($\eta^*$) which in turn push clay layers apart and result in exfoliation. Montmorillonite clay is treated with 1:1 mixture of N-[4(4-Aminobenzyl)phenyl]-5norbornene-2,3-dicarboximide, and dodecylamine (AC12), which participates in crosslinking with PMR and is more thermally stable than commercial clay (Cloisite® 30B). Rheological measurements confirm intra-gallery G' increased much more rapidly than extra-gallery $\eta^*$ – ratio of G'/ $\eta^*$ ranged from 100 to 500 $s^{-1}$, thus providing necessary force for clay layer separation. Transmission electron micrographs depict that a majority of clay particles were exfoliated in resultant composites with 2.5 and 5 wt% clay. Thermogravimetric analysis indicates $T_1$ (temperature at 5% weight loss) increased by 40°C for clay treated with AC12 compared to 20°C for Cloisite® 30B. In addition, $T_2$ (temperature at maximum rate of weight loss) increased by 30°C over neat PMR-15. These results established the viability of clay treatment and composite manufacturing methods.

**10:45 SYNTHESIS AND CHARACTERIZATION OF REACTIVE CORE-SHELL NANOPARTICLES. Ryan E. Schwarb[1], ryan.schwarb@wpafb.af.mil, Elena A. Guliants[1], elena.guliants@notes.udayton.edu, Christopher E. Bunker[2], christopher.bunker@wpafb.af.mil, [1]University of Dayton Research Institute, Nonmetallic Materials Division, 300 College Park, Kettering Laboratories, KL 562, Dayton OH 45469, [2]Air Force Research Laboratory, Propulsion Directorate, AFRL/PRTG, Wright-Patterson AFB OH 45433.**

Reactive nanoparticles are of considerable interest for potential application as catalyst, additives, and energetics. One of the key difficulties associated with reactive nanoparticles is the prevention of undesired reaction. The purpose of this research is to explore the reactivity of zero valence iron nanoparticles encapsulated by organic compounds such that the temperature of reactivity can be controlled. The method of synthesis is via sonochemistry, a well-established method for the production of these compounds. In our experiments, a solution of $Fe(CO)_5$ in dodecane is sonicated in the presence of an encapsulation compound producing core-shell nanoparticles consisting of a reactive core and a protective shell. The temperature of reactivity is determined through the monitoring of the oxygen concentration in solution using the fluorescence decay of pyrene in a temperature controlled high pressure optical cell. It is hypothesized that by changing the encapsulation compound we can control the temperature of reactivity. Encapsulation compounds oleic acid, linoleic acid, and cetyl trimethyl ammonium bromide have a temperature of reactivity; 130°C, 145°C, and 180°C respectively. By combining two of the encapsulation compounds the reaction temperature can be obtained between the pure compounds. Reactivity of these materials can be controlled and have potential application as jet fuel additives.

**11:00 STUDIES IN ICON COMPLEXITY AND VISUAL DISPLAYS. Daniel W. Repperger[1], daniel.repperger@wpafb.af.mil, Denise L. Aleva[1], denise.aleva@wpafb.af.mil, Gina F. Thomas-Meyers[1], Gina.thomas-meyers@wpafb.af.mil, Steve C. Fullenkamp[2], Steve.fullenkamp@wpafb.af.mil, [1]Air Force Research Laboratory, Bldg 33, AFRL/HEC, WPAFB, Dayton OH 45433, [2]General Dynamics Corp, Dayton OH 45433.**

The state of Ohio has the unique heritage of being the birthplace of one of the earliest models of human information processing known as Fitts' Law. The goal of this study was to determine how complex a visual computer icon could be rendered before it leads to information overload and misunderstanding to the user. A complex icon is one that portrays too many details which produces confusion. Information models are used in the data analysis. Using standard military icons with up to ten possible submenus (dimensions), subjects were trained on symbology with varying complexity. Data trials (n = 7 subjects, 3 replications) were then conducted on a test set of icons with 4-10 dimensions on a wide screen visual display. Both the time presentation interval as well as icon complexity were varied as independent variables. The computer program used was Microsoft's Visual Basic. The test trials were single interval with yes-no responses required. Of the seven subjects run, accuracy measures of performance show significant differences ($p < .05$) when dimension numbers were increased and separated by three or more dimensions. For the military icons, the saliency of each dimension was not constant. Saliency is defined as a property of the icon dimension (how it is rendered) which enables the human to correctly determine the state (on-off) of that particular dimension. The saliency performance is quantified through the human's response accuracy. Recommendations for future icon synthesis are provided in terms of saliency of particular dimensions and minimum presentation duration

# Zoology
# 9:00 AM Saturday April 22, 2006
# Kristina Mead - Presiding
# Science Center Room 107

**9:00 NUMERICAL DISCRIMINATION IN WILD MOCKINGBIRDS (MIMUS POLYGLOTTOS). Hank L. Kerschen, KerschenHL@xavier.edu, Sirisha S. Manyam, ManyamSS@xavier.edu, Michael B. Horejs, HorejsMB@xavier.edu, (George L. Farnsworth, Farnsworth@xavier.edu), Xavier University, Dept of Biology, Cincinnati OH 45207.**

Studies of captive birds in laboratory settings have demonstrated the ability of birds to discriminate between numbers of objects. Such studies often require hours of training in unnatural situations, thus limiting the inferences that can be drawn regarding numerical discrimination in wild birds. In a recent study, our research group introduced five wild northern mockingbirds (Mimus polyglottos) to experimental feeders designed to test numerical discrimination. A different number of bamboo sticks could be placed in each of two ends allowing the birds access to a food reward by removing all sticks from either end. Mockingbirds choosing the end with fewer sticks attained the food reward more quickly and easily. After repeated trials all five birds successfully discriminated between 1 and 6 sticks, as well as between 2 and 5 sticks, predominately choosing the end with fewer sticks. However, birds failed to discriminate between 3 and 4 sticks. In that study, birds received a food reward even when they chose the end with more sticks. In the current study, modified feeders prevented subjects from attaining a food reward if they chose the end of the feeder with more sticks. It was hypothesized that the increased cost associated with making the wrong choice would result in the wild birds demonstrating the ability to discriminate between 3 and 4 sticks.

**9:15 TERRITORY ESTABLISHMENT IN MOUNTAIN WHITE-CROWNED SPARROWS AT TIOGA PASS, CA. David J. Brumbaugh, dbrumbaugh@wooster.edu, (Sharon Lynn, slynn@wooster.edu.), Creagh Breuner, creagh@mail.utexas.edu, Tom Hahn, tphahn@ucdavis.edu, College of Wooster, Box C-1143, 1189 Beall Ave, Wooster OH 44691.**

Among birds, territories are often established and defended during the breeding season for feeding and nesting. Resource availability is presumably a primary factor in the establishment of territories upon arrival at breeding grounds, though few studies have addressed this directly. This investigation was designed to enhance on the understanding of the temporal patterns of territory establishment of a population of mountain white-crowned sparrows (*Zonotrichia leucophrys oriantha*) at Tioga Pass, CA in the Sierra Nevada Mountains. This species was of particular interest because unpredictable spring weather conditions on their breeding grounds may cause resource availability to vary considerably. The goal of this study was to accurately describe the formation of territories by males over time as snow melted. Territories were hypothesized to be initially large during high snow cover, and become progressively smaller as snow continued to melt, until a final breeding territory was achieved. Eight males were fitted with radio transmitters, located via radiotelemetry and recorded using a GPS unit throughout a period of 26 days, which was divided into 8 cycles of three to four days. The area within the localizations during each cycle was considered to be the activity range for that time. Areas were determined using the Spot Program (Diagnostic Instruments, Inc.). Percent snow cover was estimated from a landscape photograph taken during each cycle. Repeated-measures ANOVA

tests were conducted to detimine if there was a significant change in territory area over time, with relation to percent snow cover.

**9:30 RELATIONSHIP BETWEEN ANURAN SPECIES RICHNESS AND ABUNDANCE AND POND WATER QUALITY, David A. Kimberly, dave.kimberly@otterbein.edu, (Sarah S. Bouchard, sbouchard@otterbein.edu), One Otterbein College, SMC 10419, Westerville OH 43081.**

The global decline of amphibians is a widespread concern, and water quality may be an indicator for anuran (frog and toad) success. The goal of this study is to assess the relationship between water variables and central Ohio anuran communities in pond habitats. During the 2005 breeding season (April, May, June, July); anurans were surveyed 10 times in 21 ponds in Franklin County, using the Ohio Frog and Toad Calling Survey protocol. Ponds ranged among three varieties: retention, wooded, and non-wooded. Anuran calls from each site were recorded for three minutes. Species richness and abundance was established listening to the recorded choruses, identifying anurans to species, and then assigning a score of 0 - 3 depending on calling amount. Simultaneous with calling surveys, data were collected on several water variables, including pH, conductivity, dissolved solids, and water and air temperatures. Water samples were collected from each pond four times to measure nitrates and phosphates. It was hypothesized that ponds with poor water quality as determined by EPA standards would yield lower numbers for species richness and abundance, whereas ponds with good to exceptional water quality would yield higher numbers. Preliminary analyses indicate that only pH seemed to correlate strongly with anuran diversity and abundance. When pH was more basic (7.5-8.1) anuran communities were practically non-existent, but when pH was neutral, anuran communities thrived.

**9:45 DEVELOPMENT OF A STREAM MACROINVERTEBRATE FUNCTIONAL GROUP BIOASSESSMENT PROTOCOL FOR THE TROPICAL STREAMS OF COSTA RICA. Casey M. Hanley[1] casey.hanley@gmail.com, Benjamin C. Beaman[1], Douglas A. Vonderhaar[1], M. Eric Benbow[2], Albert J. Burky[1], [1]Dept of Biology, University of Dayton, Dayton OH 45469-2320, [2]Dept of Biology, DePauw University, IN.**

Sustainable management of stream systems and the development of bioassessment standards are important for sustainable natural resources. Macroinvertebrates and water quality data were collected in May 2005 for the development of a rapid bioassessment protocol for Costa Rican streams. Six qualitative macroinvertebrate samples were taken using 30s dip net and scouring techniques from slow flowing bank, riffle/run, and cascade habitats at three sites: a near headwaters reference site, a downstream site in Rio San Luis (Site 1 and 2), and a downstream site impacted by runoff from a small community in Rio Guacimal (Site 3). Downstream sites were assessed immediately above the confluence of Rio San Luis and Rio Guacimal. Compared to Sites 1 and 2, the Rio Guacimal had the highest conductivity (37.1, 68.1, 126.8; site 1, 2, 3, respectively), alkalinity (0.8, 22.2, 46), acidity (0.8, 1.4, 2.1), and turbidity (1.09, 1.97, 8.43). Scrapers dominated the reference site (39%) and Site 3 (44%), whereas gathering collectors dominated Site 2 (70%). Predators were most prevalent at the reference site (17.95%) compared to Site 2 and 3 (5.18% and 6.27%, respectively). The substrate stability index [(Scrapers + Filtering Collectors)/(Shredders + Gathering Collectors)] and the autotrophy to heterotrophy index [(Scrapers)/(Shredders + Filtering Collectors + Gathering Collectors)] were highest in the slow flowing habitats of Site 3 (5.3 and 5.3, respectively). These functional feeding group ratios agree with water quality data. Elevated values are associated with increased deposition and embeddedness commonly tied to eutrophication from impacted riparian runoff (e.g. Site 3).

**10:00 DOES ANTENNULE MORPHOLOGY OF THE CRAYFISH *ORCONECTES VIRILIS* CORRELATE WITH THE HYDRODYNAMICS OF THE FLOW ENVIRONMENT? Kristina S. Mead, meadk@denison.edu, Biology Dept, Denison University, Granville OH 43023.**

The local flow environment (mainstream current, turbulence, and substrate roughness) affects both the shape of the odor plume downstream of an odor source and specific features (concentration, width) of the odor filaments within the plume. The shape and arrangement of the sensors affect the thickness of the boundary layer coating the sensors, and thus their ability to extract chemical information. Since crayfish rely on chemical signals to gain information about predators, prey, and mates, crayfish aesthetascs might be physically tuned to how odors are present in the environment. Animals from different flow environments should have chemical sensors that are shaped to capture odors efficiently in that particular habitat. Antennule and aesthetasc length, diameter, and spacing were compared among three distinct populations of the crayfish *Orconectes virilis* with different flow habitats (Lake 1, flow < 1 cm/s, N=5; Hatchery 1, flow < 1 cm/s, N=6; River 1, flow=10-60 cm/s, N=3). Structural parameters were measured from SEM micrographs using Scion Image and analyzed using ANOVAs (StatView). Low flow animals had longer aesthetascs relative to filament width (0.307±0.023 um/um vs. 0.255±0.009 um/um, $p=0.0085$) that were attached to the antennule at a larger angle (48±9° vs. 29±13°, $p<0.001$) compared to high flow animals. The greater aesthetasc length and insertion angle extend the receptor-laden portion of the sensor beyond the boundary layer of slow-moving fluid created by the antennule, allowing water containing odorant molecules to be accessed by the sensors. High flow animals have shorter, less erect aesthetascs but are subject to thinner boundary layers.

## NOTES